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Catalogue of the Asteroidea (sea stars, phylum Echinodermata) collected by the IN2021_V04 and IN2022_V08 expeditions to the Australian Christmas Island and Cocos (Keeling) Islands Territories

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Abstract In this catalogue, 30 species from 25 genera and 11 families, of Asteroidea collected by the IN2021_V04 and IN2022_V08 expeditions to the Australian Christmas Island and Cocos (Keeling) Islands Territories are described and illustrated.

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Figure 1. *Evoplosoma timorensis*.

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Introduction

This is a catalogue of the Asteroidea (sea stars, phylum Echinodermata) collected by the IN2021_V04 and IN2022_V08 expeditions to the Australian Christmas Island and Cocos (Keeling) Islands Territories —Australia's Indian Ocean Territories (IOT).

Studies on the biodiversity of Australian deep-sea Asteroidea are in their infancy. Collections and documentation of asteroids are most complete for shallow-water faunas, especially those on reefs and those from nearshore and from the continental shelf. Asteroids known from greater than these depths, especially > 500 m and especially from bathyal and abyssal habitats are poorly documented.

This catalogue contains 20 new occurrence records for Australia relative to the lists of Rowe & Gates (1995).

Methods

Station details and collection methods are described in O'Hara (2024).

Systematic account

Order Brisingida

Diagnosis and comments Asteroids in the order Brisingida, informally referred to as "brisingids" are a group of specialized forcipulatacean asteroids, all characterized by having crossed, 3-piece pedicellariae, which occur primarily in the deep-sea and are characterized by having 6 or more elongate arms, each bearing long lateral spines, each covered by a sheath heavily invested with pedicellariae. Internally, most brisingids are characterized by the possession of a fused disk and vertebrae-shaped ambulacral and adambulacral ossicles.

Morphology in brisingids reflects their suspension feeding life mode. Most observed brisingids suspend their arms into the water current allowing current flow to bring food, mostly small crustaceans to their pedicellariae-covered lateral spines. The pedicellariae capture prey which are then conveyed to the mouth with tube feet (Emson & Young, 1994).

Brisingids are often confused with other forcipulate or asteriid sea stars with elongate arms, such as *Coronaster*. The former are distinguished from the latter by the shape of the ambulacral ossicles which are vertebrae-shaped rather than the compressed, wing shape observed in the latter. With the exception of the shallower-water *Brisingaster helenae* and *Novodinia australis*, from 300–600 m, brisingids have not been recorded from deep water Australian settings. Taxa summarized herein are among the first from deeper water settings.

Family Brisingidae

Hymenodiscus sp.

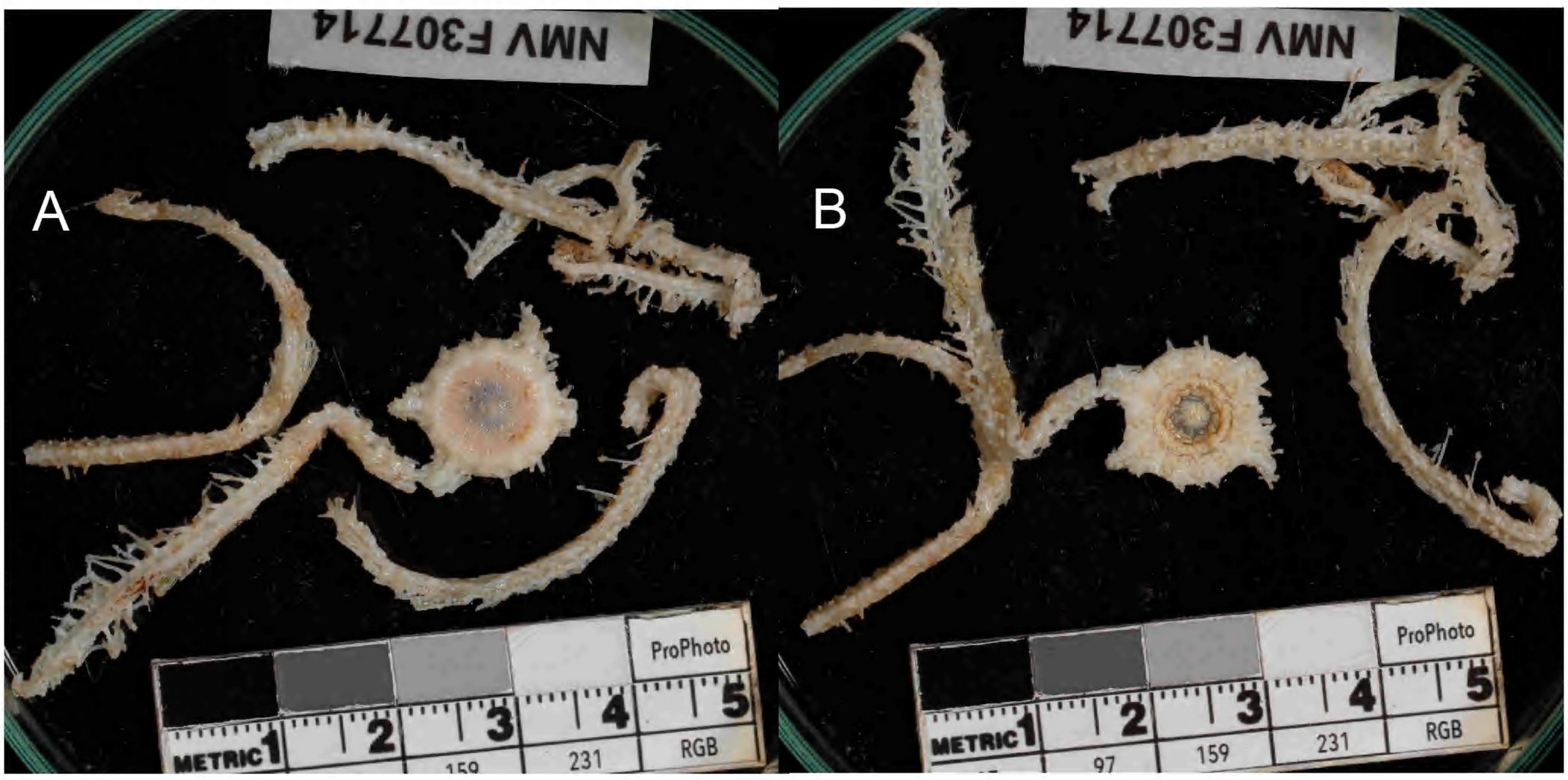


Figure 2. *Hymenodiscus* sp. NMV F307714 (Op 126).

Diagnosis Arms 8–12, skeletal ribs (aka costae) present along arms with bare skin between them. Bar shaped plate present interradially, no fused proximal adambulacrals. Gonads arm base. Papulae absent.

Taxonomic remarks This genus was previously known as *Brisingella* prior to work by Mah (1998). Sixteen species are recorded. This is the first record of this genus from Australian waters.

Distribution Distribution: Present primarily in North and tropical Atlantic and throughout the Pacific and Antarctic waters. IOT: Cocos Abyssal, Cocos Keeling Islands, Christmas Island, Clara Marie Seamount, Muirfield Seamount, 808–5414 m.

Ecology and life history Consistent with the behavior

observed in other brisingids, *Hymenodiscus* has been observed perched on rocks and other substrata permitting the animals to hold their arms into the water currents away from the bottom.

Family Freyellidae

***Freyella* sp.**



Figure 3. *Freyella* sp. NMV F307717 (Op 122).

Diagnosis Arm 6 to 14, plates flattened, tesselate. Plate present in each interradius, papulae absent. Proximal adambulacral plates joined with tissue. Gonads paired.

Taxonomic remarks *Freyella* includes approximately 31 species and is among one of the more commonly encountered brisingid taxa. However, in spite of work by Zhang *et al.* (2023), many remain problematic and based on fragmentary material. *Freyella* occurs primarily in bathyal to abyssal habitats (approximately

1000–000 m).
Distribution Atlantic, Pacific, Indian, Antarctic region. 1000–7000 m. IOT: Investigator Ridge, 4980–4990 m.
Ecology and life history As members of the Freyellidae, *Freyella* species are encountered in deeper-water settings, approximately 500 to 7000 m depths, but mostly between 1000 to 7000 m. *Freyella* species have been observed on both hard and soft substratum. It is unclear if those which are present on soft-bottoms somehow exploit current regimes different from those present on rocks and other projections above the surface of the bottom. These are the first records of *Freyella* in Australia.

Order Forcipulatida

Family Asteriidae

Genus *Coronaster* Perrier, 1885

Diagnosis Disk small, discrete, arms 6 to 12, elongate and deciduous. Abactinal skeleton is open and reticulate with quadrate meshes. Abactinal and marginal spines prominent with pointed tips and distinct wreaths of pedicellariae present. Actinal plates absent, Furrow spines 1 to 3. Tube feet quadriserial to biserial. Modified from McKnight (2006).
Taxonomic Remarks *Coronaster* includes 8 species present in temperate to tropical waters at variable depths, 10 to 1045 m. Rowe & Gates (1995) list two species from Australian waters, one of which is represented by IOT collections. Although body morphotypes vary, surprisingly few character differences differentiate among *Coronaster* species making distinctions different and further revision desirable.

***Coronaster* sp.**



Figure 4. *Coronaster* sp. NMV F307698 (Op 163).

Diagnosis Arms 9. Disk small, arms deciduous, variably thick and elongate. Abactinal skeleton reticulate, furrow spines 2.

Taxonomic remarks The combination of arm and furrow spine number are inconsistent with known Australian species. Species that are in accord with size and the presence of 2 furrow spines include *Coronaster reticulatus* from New Zealand displaying 6 arms and possibly *Coronaster pauciporis* from New Caledonia displaying 12–13 arms or alternatively, this could be an undescribed species. Further work is desirable.

Distribution Globally (for genus): New Zealand, near the Kermadec Islands and the Philippines. 260–898 m. IOT: Muirfield Seamount, 527–528 m.

Ecology and life history Nothing is available regarding this species' biology.

Coronaster volsellatus **(Sladen, 1889)**

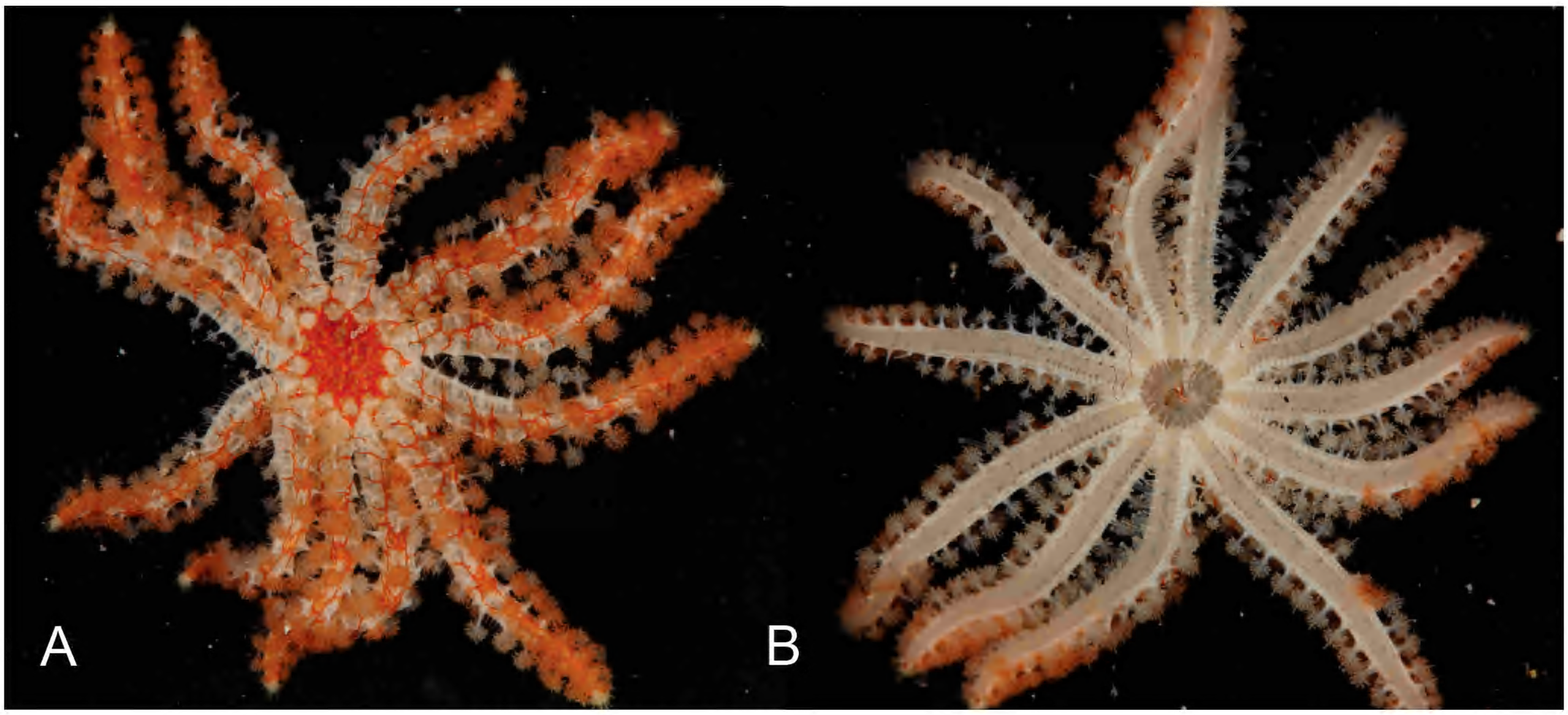


Figure 5. *Coronaster volsellatus*. NMV F307699 (Op 163).

Diagnosis Arms 13. elongate, tapering. Abactinal skeleton reticulate, furrow spine one.

Taxonomic remarks As indicated elsewhere, taxonomic boundaries between this and other *Coronaster* species make determination difficult. *Coronaster volsellatus* occurs in overlapping regions with other similar *Coronaster* species, such as *Coronaster halicepus*. Additional specimens have added to our knowledge of character variation in this genus and made boundaries between species problematic.

Distribution Globally: The Philippines, 216–302 m. IOT: Muirfield Seamount, 169–176 m.

Ecology and life history Little to nothing is known regarding this species' biology.

Family Zorasteridae

Zoroaster **sp.**



Figure 6. *Zoroaster* sp. NMV F307989 (Op 116).

Diagnosis Disc small. Disc and arms with imbricate skeleton. Carinal plates ridge-like. Primary spines present or absent on carinals, marginal plate series. Superambulacrals reduced. Internal buttress absent. Based on Mah (2007).
Taxonomic remarks Globally, *Zoroaster* includes 20 living and 2 fossil species. Most species are distinguished by relatively few characters and with increased specimen sampling and better understanding of character variation boundaries between species is difficult, especially for Indo-Pacific species. Further complicating the issue, molecular data suggests different morphotypes present at different bathymetric depths (Howell *et al.*, 2004). Although 16 specimen lots were examined, owing to time constraints and taxonomic difficulties, it was unclear how many species were present. IOT specimens are among the first *Zoroaster* sp. to be recorded from Australian waters, although collections from other collections suggest widespread Australian occurrence.
Distribution Global Distribution (for genus): Atlantic, Pacific, Indian Ocean. 145–4810 m. IOT: Clara Marie Seamount, Santa Ridge, Raitt Ridge Seamount, Santa Ridge, Raitt Ridge North Seamount, Balthazar Seamount, Apollo Seamount, Scrooge Seamount. 1736–2435 m .
Ecology and life history A combination of *in situ* observations from the North Atlantic *Zoroaster fulgens* and examination of specimen gut contents suggests that *Zoroaster* sits on sediment surface or subsurface and utilize their oral and furrow spination to feed on mollusks and other food present in the sediment (Mah, 2024). Pacific species likely practice a similar type of feeding behavior.

Order Paxillosida

Diagnosis Arms five, body stellate to strongly stellate in most. Abactinal surface varies, but many with paxillate plates, others with spines, and/or well-developed dermis. Marginal plates in all but Luidiidae form distinct frame with dorsal or lateral-facing frame. Marginal plates variable, but paxillate in Radiasteridae, more quadrate in others. Anus absent and tube feet pointed in all but Pseudarchasteridae, Benthopectinidae. Cribiform organs present in Porcellanasteridae and Goniopectinidae.
Comments Members of the Paxillosida have historically been interpreted as demonstrating and being characterized by adaptations for living in or on unconsolidated sediments with some groups, such as the Porcellanasteridae and the Goniopectinidae, demonstrating "mud swallowing" or deposit feeding life habits. Groups such as the Astropectinidae and the Luidiidae live buried in subsurface sediment predating on mollusks and other prey. Phylogenetic survey of the Asteroidea has since shown several closely affiliated taxa to be members of the Paxillosida, including the Benthopectinidae and the Pseudarchasteridae.

Family Astropectinidae

Diagnosis Arms five, body stellate to strongly stellate in most. Abactinal surface with paxillate plates. Marginal plates paxillate or forming distinct dorsal or lateral-facing frame. Anus absent, tube feet pointed.
Comments The Astropectinidae is the most diverse group known within the Paxillosida, including approximately 243 species in 26 genera and occurring in all oceans and present in very different habitats ranging from shallow-water tropical (e.g., *Astropecten*) to deep-sea (to 6000 m) habitats (e.g. *Dytaster*). Astropectinids, like most Paxillosida, display morphological adaptations, such as pointed tube feet and paxillate abactinal plates, for occurring in loosely consolidated sediment covered bottoms, such as sand or mud. Genera within the Astropectinidae have been distinguished based on internal as well as subjective external characters, making some distinctions difficult. *Thrissacanthias* for example was separated from *Persephonaster* based on the presence of gonads in the arms relative to the disk and the New Zealand *Proserpinaster* was argued as distinct based on "broadened interradial inferomarginal plates." These characters have not been reviewed and distinguishing them without close examination is problematic. Eight astropectinid genera have been recorded from Australian waters (Rowe & Gates, 1995), primarily from shallow-water settings. *Astropecten* and *Psilaster* were recorded from IOT specimens with *Dytaster*, *Plutonaster* and *Persephonaster* recorded as new occurrences.

***Astropecten* sp.**

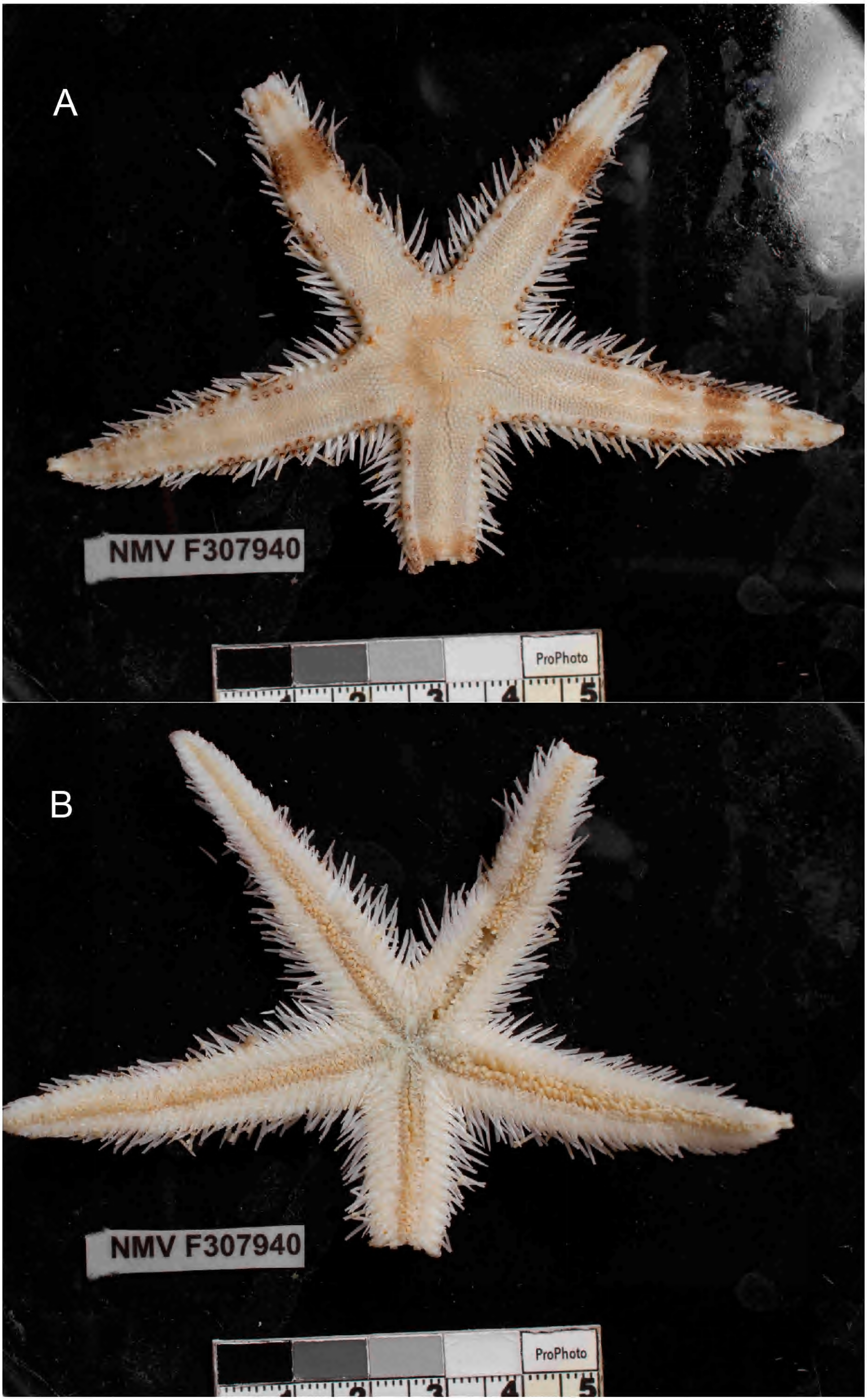


Figure 7. *Astropecten* sp. NMV F307940 (Op 172).

Diagnosis Arms five, body with distinct marginal plate periphery with distinct superomarginal and inferomarginal series. Paired spines present on superomarginals in each interradius as well as on intermittent superomarginals along arm. Elongate inferomarginal spines present. Actinal plates few restricted to disk. Superambulacral plates present. Body white with brown star centrally located on disk. Brown to tan bands, 3 to 5 present along arms.
Taxonomic remarks Identification of this species was made from imagery and remains uncertain, but it bears resemblance to *Astropecten zebra*, displaying a similar color pattern and similar spination on the superomarginal and inferomarginal plates albeit at a much greater depth than previously recorded. *Astropecten* contains over 95 living species and over 25 fossil species. Marsh & Fromont (2020) list 14 Australian species with 11 present in shallow-water settings. Clark & Rowe (1971) list approximately 20 from the Indian Ocean. Zulliger & Lessios (2010) performed a global phylogeny for *Astropecten* and discovered cryptic species in wide-ranging species such as *Astropecten polyacanthus*. Species distinctions in *Astropecten* are complex and in some species difficult to observe. Identification keys to shallow-water species include those of Clark & Rowe (1971) and Marsh & Fromont (2020). Deeper-water *Astropecten* are treated by Fisher (1919). Most species of *Astropecten* are known from 200m or shallower, but some are known to occur in excess of 1000 m (Clark, 1989b).
Distribution Globally. Northern coast of Australia extending to Sri Lanka and Indonesia, 3–41 m. IOT: Muirfield Seamount, 121–176 m.
Ecology and life history Most *Astropecten* spp. are infaunal predators, burying themselves in sediment and swallowing mollusks and other prey items (Jangoux, 1982; Marsh & Fromont, 2020). Ventura (1989) has provided an exhaustive review of available ecology and biology of *Astropecten*.

***Dytaster* sp.**

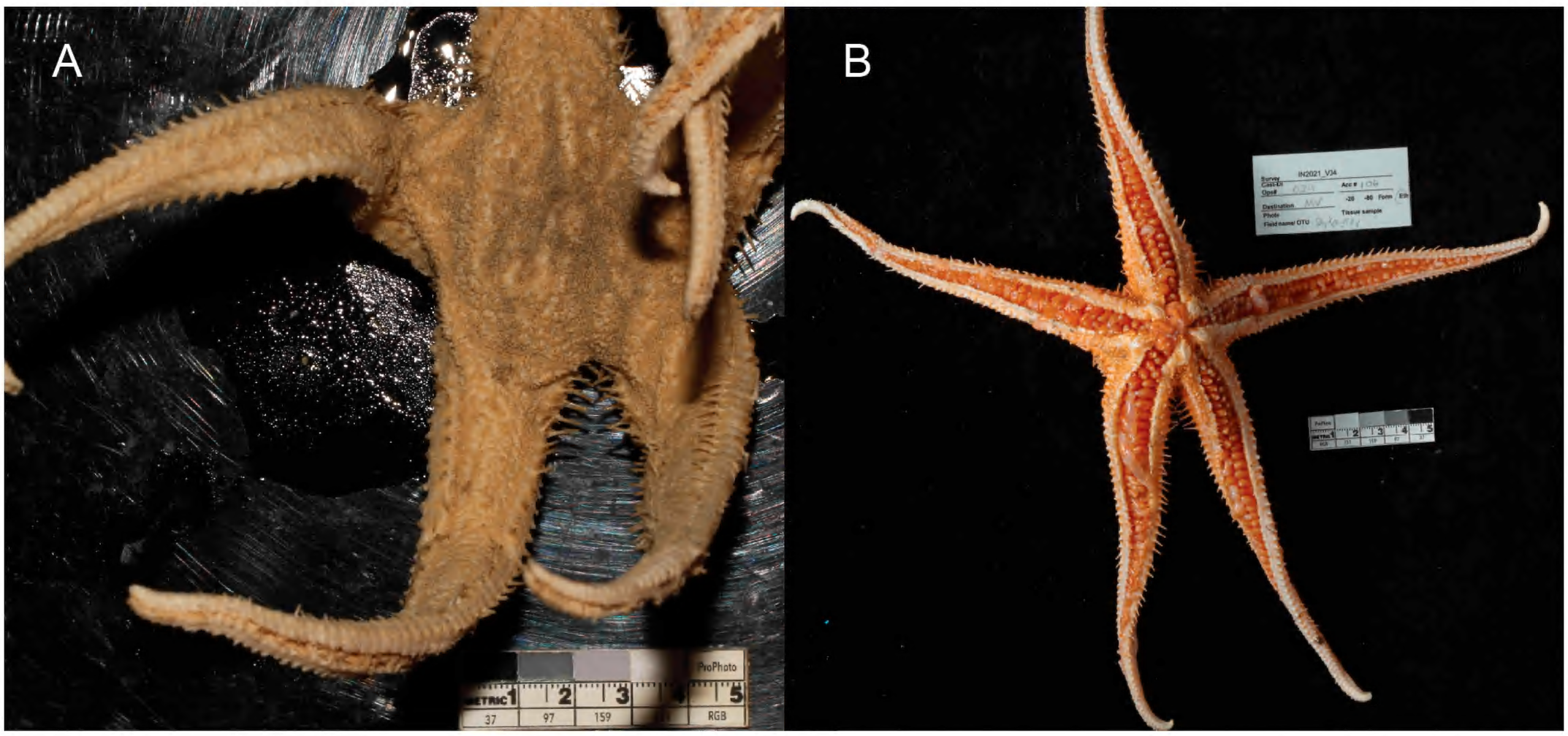


Figure 8. *Dytaster* sp. (A) NMV F307897 (Op 103), (B) NMV F307616 (Op 024).

Diagnosis Arms 5, disk small, arms elongate, arms narrow. Abactinal surface thin, paxillae weakly developed, irregular. Madreporite large, conspicuous, covered with paxillae. Marginal plates thin, rectangular, most with a prominent spine. Actinal intermediate area with thin plates, imbricate. Furrow spines numerous in straight series. Based on Clark & Downey (1992).
Taxonomic remarks Arms 5, disk small, arms elongate, arms narrow. Abactinal surface thin, paxillae weakly developed, irregular. Madreporite large, conspicuous, covered with paxillae. Marginal plates thin, rectangular, most with a prominent spine. Actinal intermediate area with thin plates, imbricate. Furrow spines numerous in straight series. Based on Clark & Downey (1992)
Distribution Globally (for genus): Throughout the Pacific and Atlantic, 1460–4360 m. IOT: Abyss South of Christmas Island, Clara Marie Seamount, Balthazar Seamount, 3007–4766 m.

Ecology and life history Species in the genus *Dytaster* occur primarily in bathyal to abyssal habitats, 1460–4360, primarily between 2000 to 3500 m and is generally found in association with muddy bottoms with mud present in the oral cavity. Observed Atlantic species of *Dytaster* shows them buried in the subsurface of soft sediment bottoms (Mah, 2020). Reproductive biology of the Atlantic *Dytaster insignis* was documented by Tyler & Pain (1982).

***Persephonaster* sp.**

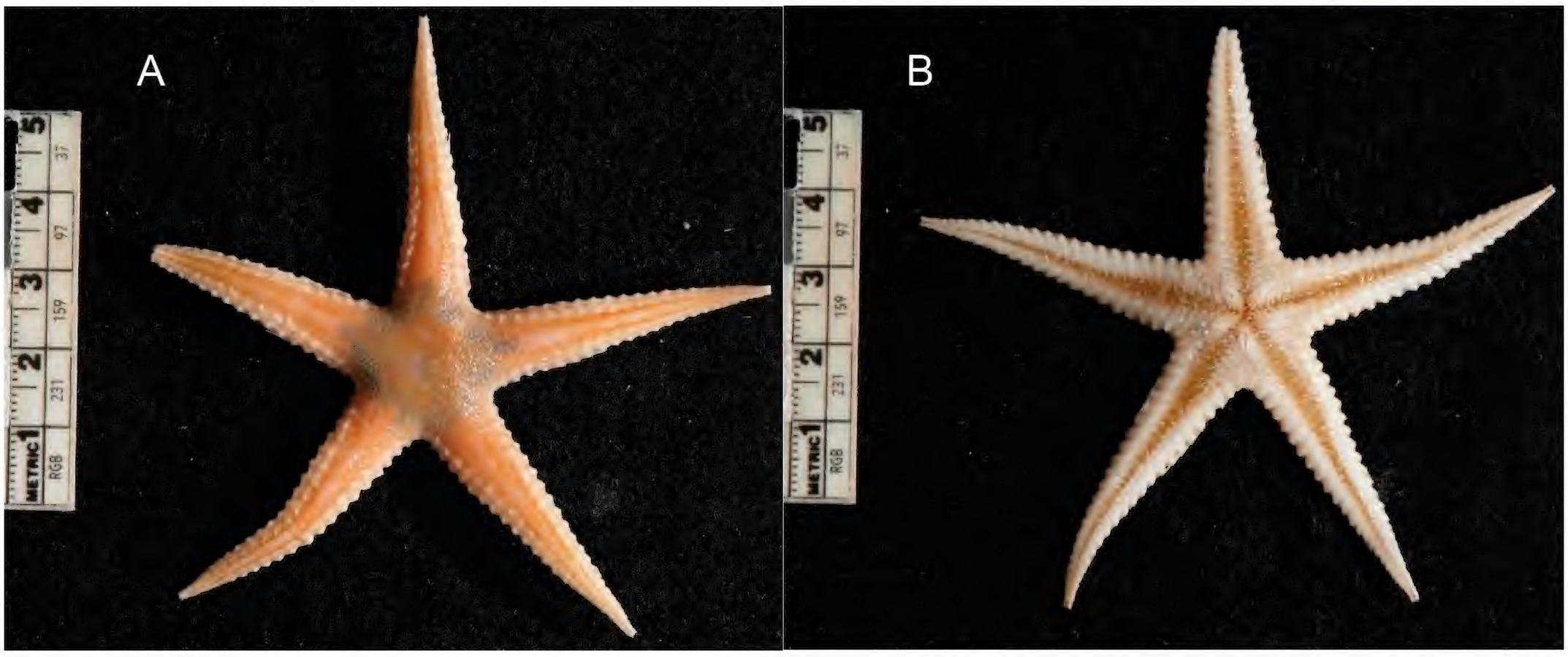


Figure 9. *Persephonaster* sp. NMV F307875 (Op 159).

Diagnosis Arms 5, stellate or strongly so, tapering or attenuated at tips. Interbrachial arcs acute. Abactinal plates forming ordered series with multiple spinelets, presenting a hirsute appearance, overall abactinal surface wider at base, narrowing distally. Superomarginals with a bevelled/sloping edge.

Taxonomic remarks A genus with approximately 25 species distributed throughout the Atlantic, Pacific and Indian oceans, primarily in deep-sea habitats, 160-3430 m. Fisher (1919) reported numerous species from the central Pacific displaying close similarity and in some cases, few character differences. This is similarly the case for Atlantic species (Clark & Downey, 1992). Distinctions between *Persephonaster* species and the seemingly indistinct New Zealand *Proserpinaster* defined by "broadened interradial inferomarginal plates" further add to understanding of *Persephonaster*'s difficult taxonomy. No *Persephonaster* have been recorded from Australian waters, but approximately 7 species are known from the Indian Ocean.

Distribution Globally (for genus), Atlantic, Pacific and Indian Oceans, 160–3430 m. IOT: Apollo Seamount, Balthazar Seamount, Rudist Seamount, Cocos (Keeling) Island, Noel Seamount, Muirfield Seamount, Southwest Cocos Islands.

Ecology and life history Aside from the general knowledge of this genus as an astropectinid, little is known regarding the biology or ecology of species in this genus.

Persephonaster sp.2

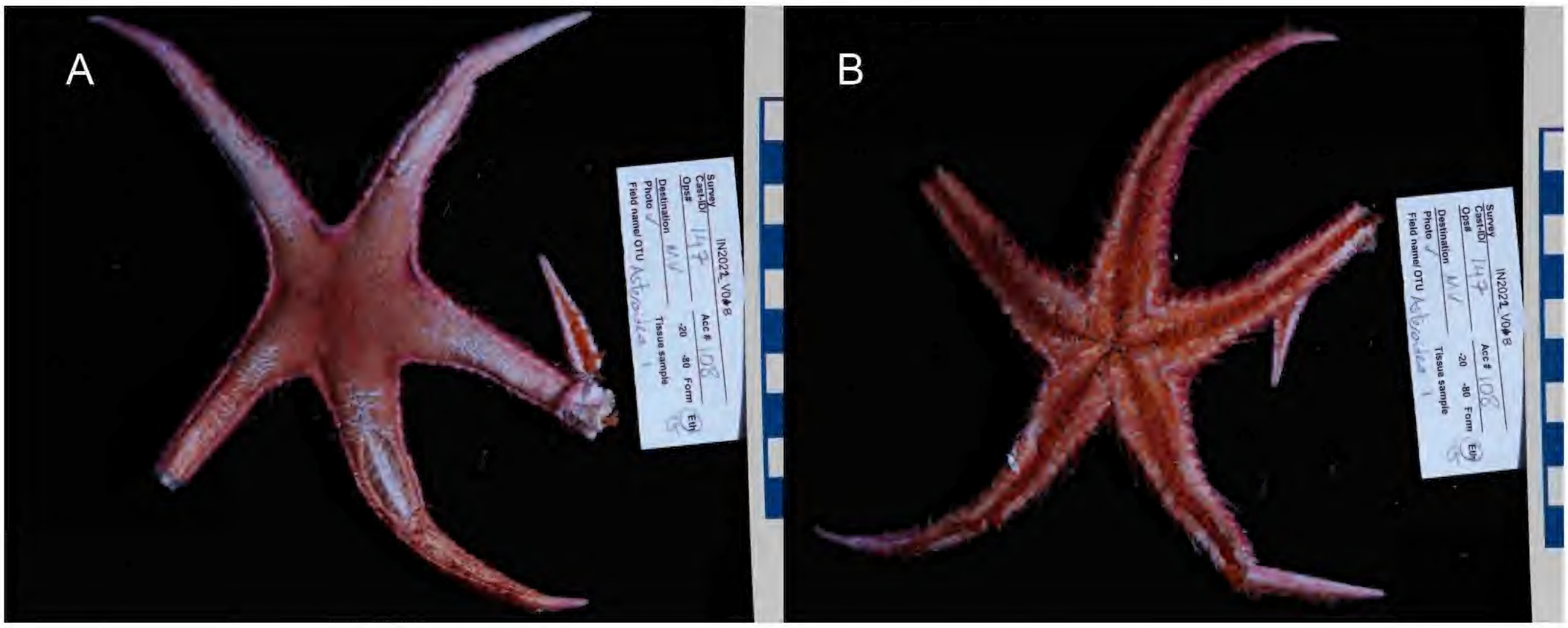


Figure 10. *Persephonaster* sp.2 NMV F307956 (Op 147).

Diagnosis Body is strongly stellate (R/r=5.5), arms elongate, tapering. Abactinal paxillae in transverse series along arms, densely arranged on disk. Marginal plates lateral facing, multiple spines, 3 to 6 present on superomarginals and inferomarginal plates. Actinal areas small, dense spine clusters on actinal plates. Furrow spines approximately 8 per plate, subambulacral spines approximately 10. Tube feet pointed.

Taxonomic remarks Determination of this taxon was inconclusive. Further work is needed, but it is possibly undescribed.

Distribution Noel Seamount, 2617–2721 m.

Ecology and life history Information specific to this species is unknown, but as with all Astropectinidae, adaptations suggest a life mode adapted to burial in loosely consolidated sediment.

Plutonaster sp.

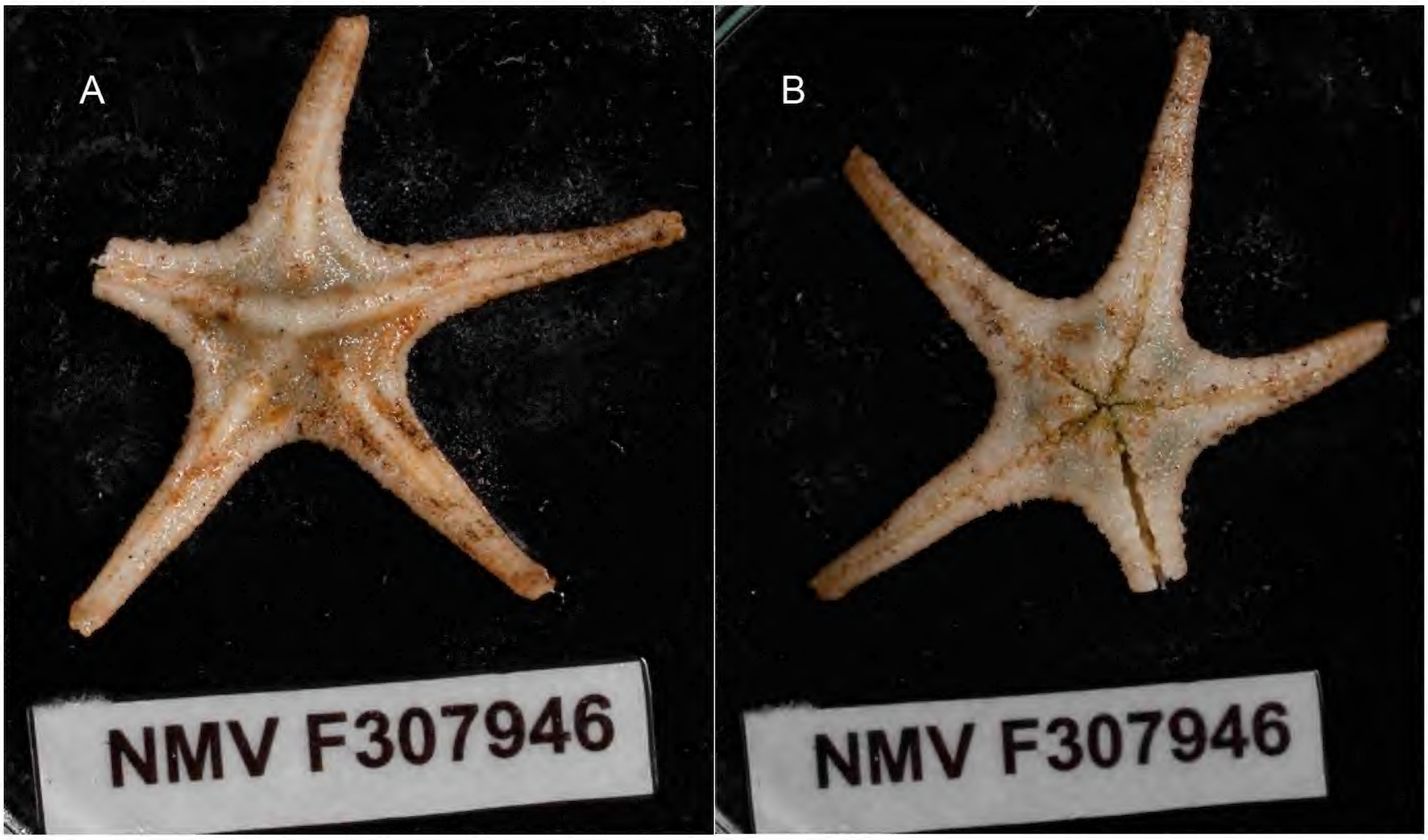


Figure 11. *Plutonaster* sp. NMV F307946 (Op 122).

Diagnosis Arms 5, body weakly stellate to stellate. Disk flat, broad, arms triangular, variably broad to elongate. Interbrachial arcs rounded. Abactinal surface paxillate, irregularly distributed. Superomarginal plates wide, conspicuous forming distinct periphery around dorsal to lateral surface. Spines variably present or absent, when present conical to pointed. Actinal plates forming distinct fasciolar rows.

Taxonomic remarks *Plutonaster* contains approximately a dozen species present primarily in the Atlantic and the Pacific. Specimens herein are the first occurrence of *Plutonaster* from the Indian Ocean. Although no species are recorded from Australia, *Pseudarchaster ambiguus* is recorded from the Tasman Sea. Based on summaries from the Atlantic (Clark & Downey, 1992) and New Zealand (Clark & McKnight, 2000) *Plutonaster* species are distinguished based on combinations of arm shape and variation in spines and granules which can show overlap, especially with differently sized individuals. Small individuals are a regular source of difficulty as evidenced by the summary of *Plutonaster* sp. juveniles reported without identifications by Clark & McKnight (2000).

Distribution Globally (for genus): Atlantic, Pacific, 906–2180 m. IOT: Southeast Christmas Island, Christmas Island off McPherson Point, Karma Seamount, Clara Marie Seamount, Shcherbakov Seamount, Balthazar Seamount, Glogg Seamount, Investigator Ridge Abyssal, Cocos (Keeling) Island, Noel Seamount, Raitt Ridge North, Muirfield Seamount, Santa Ridge, Cocos Abyssal, 1451–5414 m.

Ecology and life history Several papers on the reproductive biology and distribution of the Atlantic *Plutonaster bifrons* are available (Tyler & Pain, 1982; Tyler *et al.*, 1993; Young *et al.*, 1996) and others. However, beyond generalities associated with astropectinid life modes, nothing for Indian Ocean *Plutonaster* could be located.

Psilaster sp.

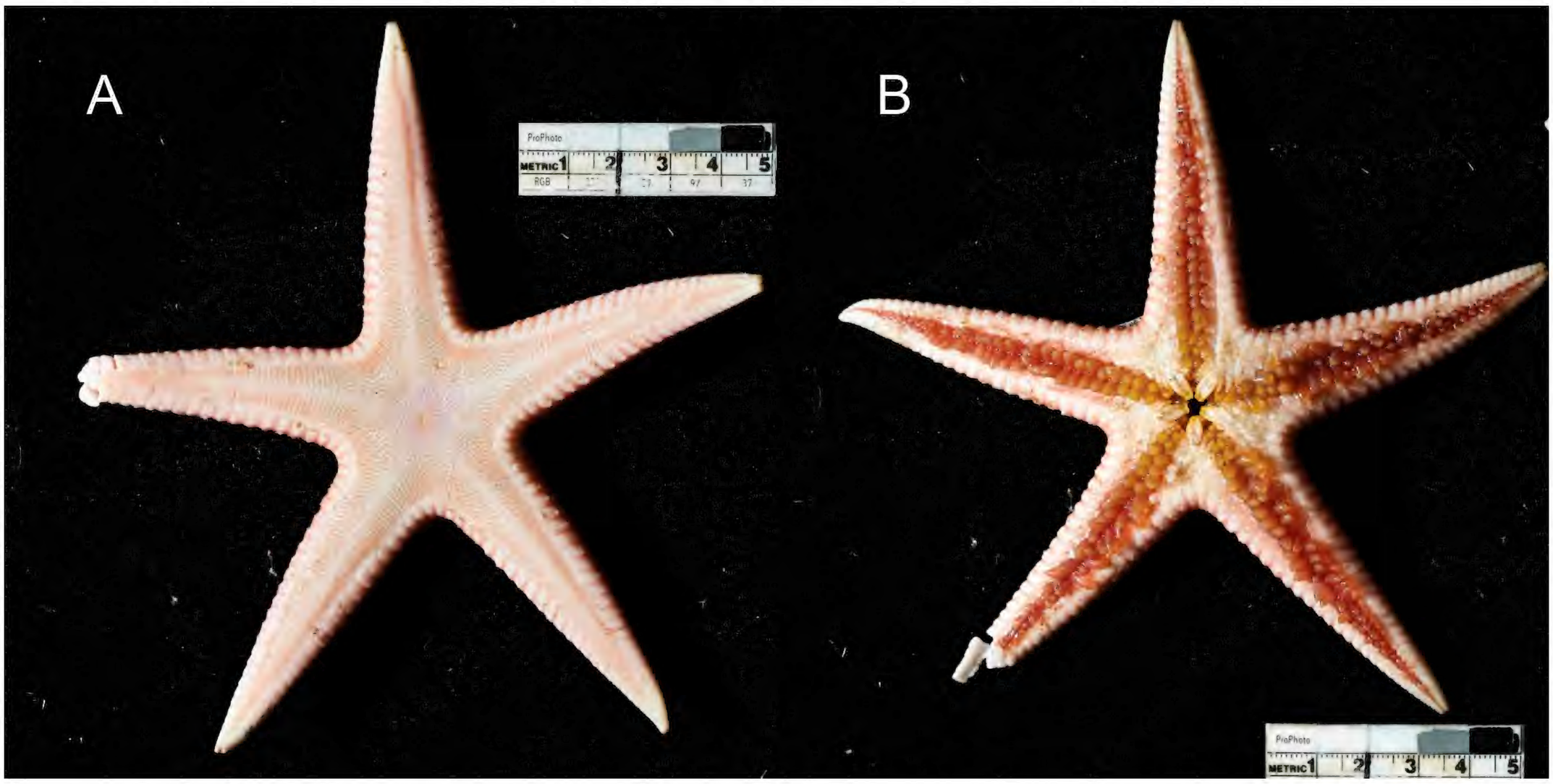


Figure 12. *Psilaster* sp. NMV F307623 (Op 037).

Diagnosis Arms 5, disk small, arms triangular, sharply tapering with pointed tip. Interradial arcs acute. Marginal plates distinct, with dorsolateral facing. Proximally body thick, narrowing distally. Inferomarginal plates with spines, one to several, directed downward, appressed along the arm.

Taxonomic remarks *Psilaster* includes 12 species present in the Pacific, Atlantic and Southern Oceans. Based on summaries from the Atlantic and New Zealand (Clark & Downey, 1992; Clark & McKnight, 2000) species in this genus are differentiated primarily based on body ratios and characters that show overlap and/or are very similar. One species, *Psilaster acumina-tus* is recorded from southeastern Australia, 146-1150 m. This specimen represents a first occurrence for this genus in the Indian Ocean.

Distribution Globally (as for genus): Pacific, Atlantic, Southern Ocean, 146–1150 m. IOT: Apollo Seamount, 1640–1850 m.

Ecology and life history Reproductive biology in the Atlantic species was studied by Tyler & Pain (1982) and the Antarctic *Psilaster charcoti* appears as a subject in numerous studies (e.g., (McClintock, 1989, 1994). As with other astropectinids, *Psilaster* sp. is likely a predator feeding in soft sediments.

Family Benthopectinidae

Diagnosis Arms 5, elongate and attenuated, dorsoventrally flattened, longitudinally flexible. Abactinal plates variably spinose. Papulae restricted to limited proximal areas on arms. Marginal plates forming well-developed peripheral frame, spines and/or spinelets present on most taxa. Pedicellariae fasciculate or pectinate numerous spongiform valves. Superambulacral plates absent. Tube feet flat. Dorsal muscles developed along length of each arm. Anal opening present. Modified from Clark & Downey (1992).

Comments The Benthopectinidae, which includes 8 living and 2 fossil genera, occur primarily in cold-water settings, such as those at high-latitudes and in the deep-sea (> 200 m). Benthopectinids occur in all of the world's oceans, sometimes in high abundance. Little is known about their ecology and biology but gut contents suggest bottom predators or scavengers (Jangoux, 1982). In situ observations have recorded them on both hard and soft-bottom substrates. Benthopectinids had historically been placed in the Notomyotida, a grouping which included the Benthopectinidae and the fossil Paleobenthopectinidae. Molecular phylogenetic work (Mah, 2011) has placed the Benthopectinidae within the Paxillosida broadening the definition of the latter to also include the Pseudarchasteridae.

***Benthopecten* sp.**

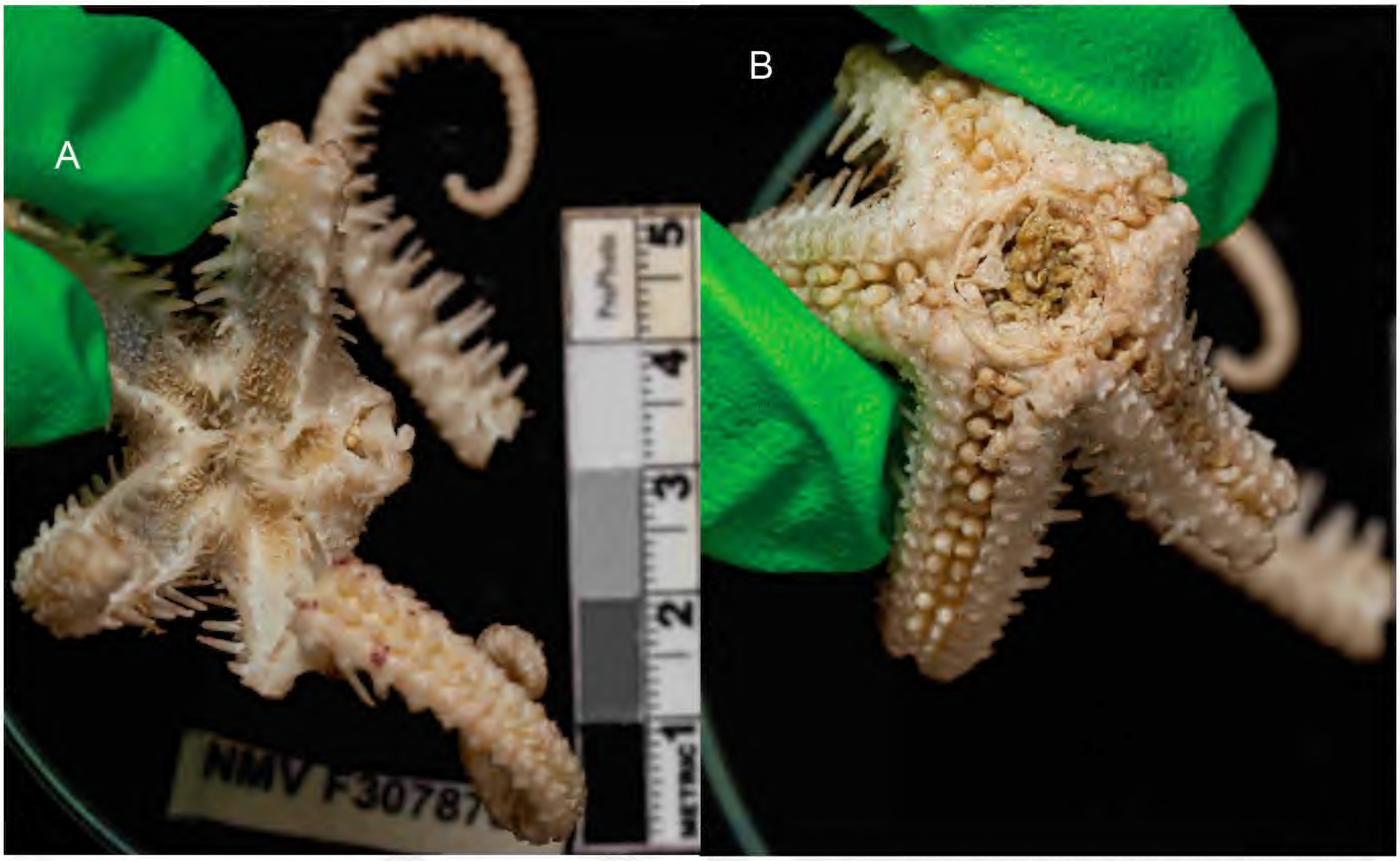


Figure 13. *Benthopecten* sp. NMV F307870 (Op 105).

Diagnosis Distinguished by the presence of an odd interradial marginal plate present in all five interradii, generally with a prominent spine on each. Abactinal plates thin, flat, scale-like to spinose. Papulae scattered on arm bases, distributed proximally on the arms and disk. Marginals with large primary spines and associated smaller secondary spines. Furrow spines 3–8 with subambulacral spines, 1–2, large, prominent. Pectinate pedicellariae present or absent variably present on abactinal, inferomarginal, actinal plates. Modified from Clark & Downey (1992).

Taxonomic remarks A widely occurring genus which includes 23 species present in the Atlantic, Pacific, Indian oceans at relatively deep depths, 418–3700 m. Although varied, most species appear to be distributed in the 1000 to 3700 m range. Although recorded from New Zealand, no species of *Benthopecten* have previously been recorded from Australia (Rowe & Gates, 1995), making this occurrence the first.

Distribution Globally, Atlantic, Pacific, Indian Oceans. 418–3700 m. IOT: Balthazar Seamount, Clara Marie Seamount, Shcherbakov Seamount, Cocos Abyssal, Noel Seamount. 1608–2721 m.

Ecology and life history Little is known regarding the biology or ecology of these animals.

***Cheiraster* sp.**

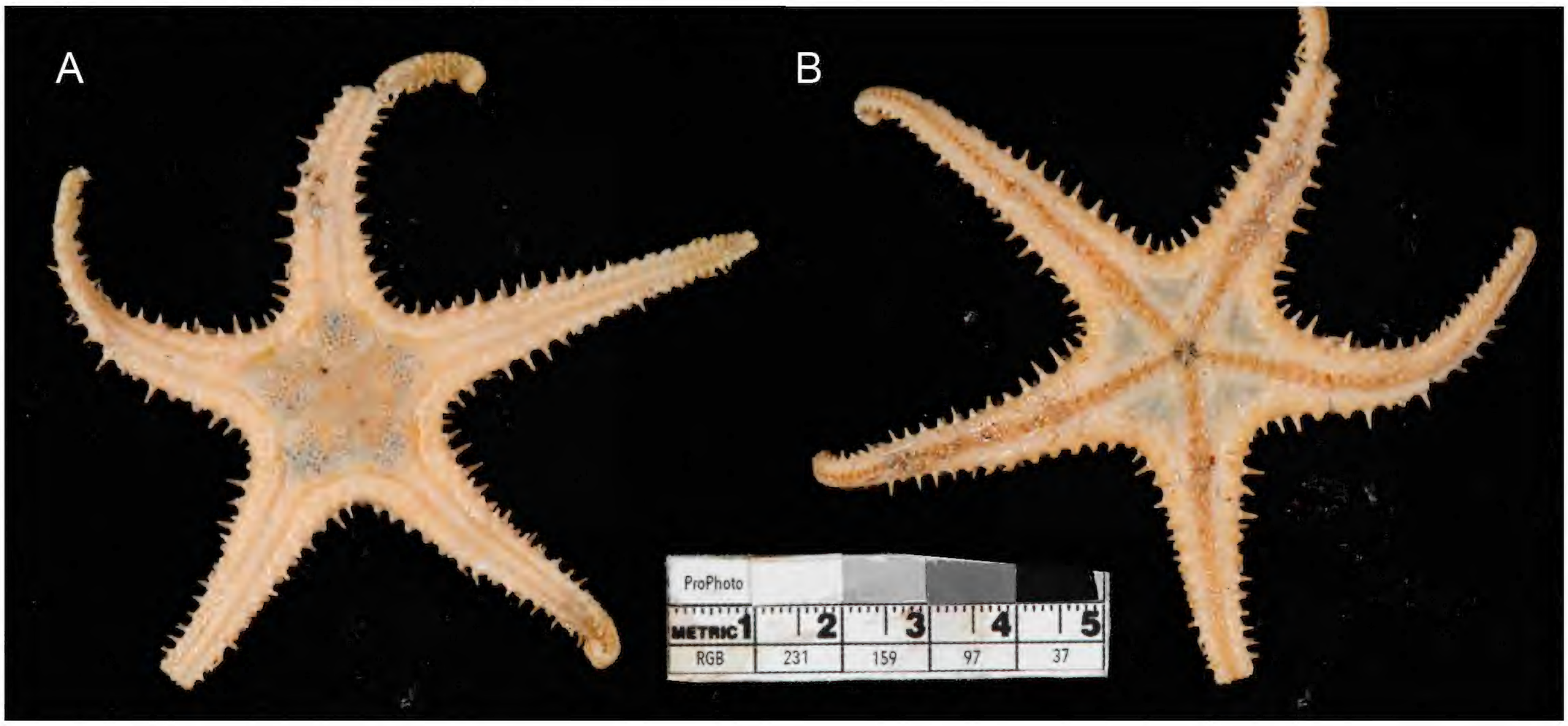


Figure 14. *Cheiraster* sp. NMV F307592 (Op 012).

Diagnosis Characterized by the absence of odd interradial marginal plates, i.e. even count of marginals present in each proximal interradius. Abactinal plates variably with spines/spinelets and/or low with spineless plates. Papulae present at proximal arm region emerging as two lobes. Marginal plates with dorsal to lateral facing. Subambulacral spines 1 to 3. Pedicellariae fasciculate. Tube feet with flat surfaces/disks.
Taxonomic remarks *Cheiraster* includes approximately 23 species. These had historically been described as members of 3 genera, which were made into subgenera of *Cheiraster*. Species are present in the Atlantic, Pacific, Indian and Southern oceans from a wide depth range, 100-3250 m with most species present in the upper depth range, 100-1000 m. Six species of *Cheiraster* are listed from Australian waters (Rowe & Gates, 1995).
Distribution Globally: Atlantic, Pacific, Indian and Southern Ocean. 100–3250 m. IOT: Balthazar Seamount, Lucia Seamount, Apollo Seamount, Christmas Island off McPherson Abyssal.
Ecology and life history Little is known regarding the biology or ecology of these animals.

Family Porcellanasteridae

Diagnosis Arms 5, triangular, abactinal surface thin, variably with imbricate plates, spinelets, paxillae and/or distinct dermal covering. A central tubular structure, the epiproctal cone, emerging from central disk present or absent. Marginal plates large forming distinct border with unique cribriform organs, 1 to many, between plates. Superomarginal plates variably abutted over midline. Actinal plates formed from plates formed from abutted pavement overlain or embedded in distinct membrane. Furrow spines few (1 to 3). Pedicellariae absent. Tube feet pointed. Modified from Clark & McKnight (2000) & Clark & Downey (1992).
General comments on Life Mode Accounts summarizing life mode of porcellanasterid sea stars indicates they are "mud-swallowers", apparently deposit feeders which bury themselves in finely packed sediment from which they obtain food (Madsen, 1961). With the exception of *Benthogenia* and *Lysaster*, most porcellanasterids occur at excessive depth, 1000 to 9000 m with many taxa displaying widespread or even cosmopolitan distributions. Although technically outside the nautical limit, only one species, *Porcellanaaster ceruleus* has been recorded from Australian waters (Rowe & Gates, 1995). The four species listed herein are new records for Australia. Porcellanasterids possess several distinctive characters, but among the most diagnostic is the presence of cribriform organs. These are papillate/spinose coverings present between marginal plates extending from the single plates proximally to

marginal plates present along the complete interradius, arm tip to arm tip. Although never experimentally tested, it is thought that they function in respiration by generating ciliary currents along the surface of the animal presumably as part of their infaunal life mode.

Abyssaster tara (Wood-Mason & Alcock, 1891)

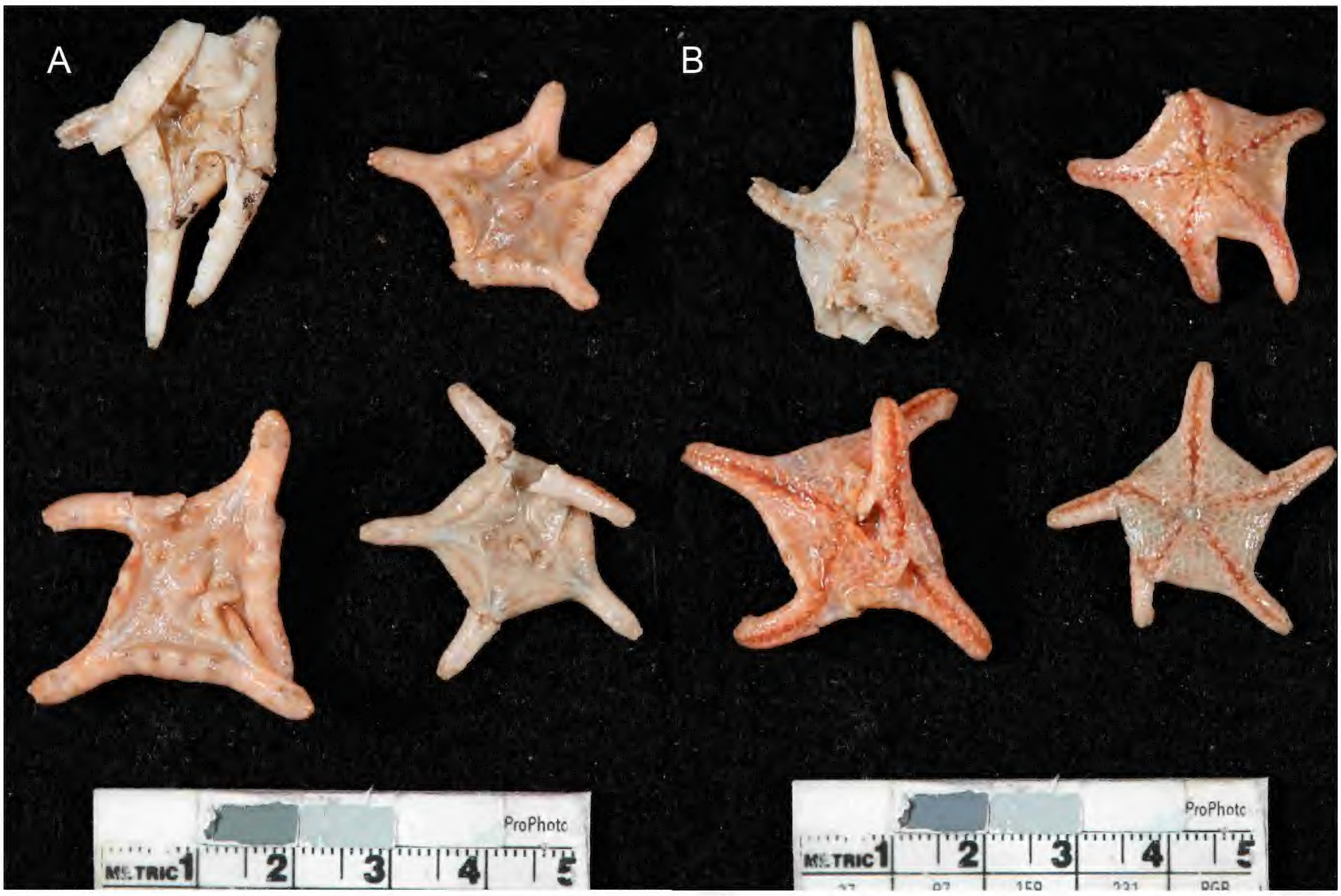


Figure 15. *Abyssaster tara*. NMV F307809 (Op 183).

Diagnosis Superomarginal plates not in contact, abactinal plates extending to terminus. Spines absent from superomarginal plates. Cribiform organs 3, confined to disk. Oral plates with a single, enlarged mouth spine.

Taxonomic remarks This species has not been recorded from Australian waters.

Distribution Globally: Indian Ocean, along the east African coast, Bay of Bengal, North Pacific. 3200–6280 m. IOT: Muirfield Seamount, 3948–4047 m.

Ecology and life history Beyond the general knowledge for Porcellanasteridae, little is known regarding the specific biology or ecology of this species.

***Hyphalaster* sp.**

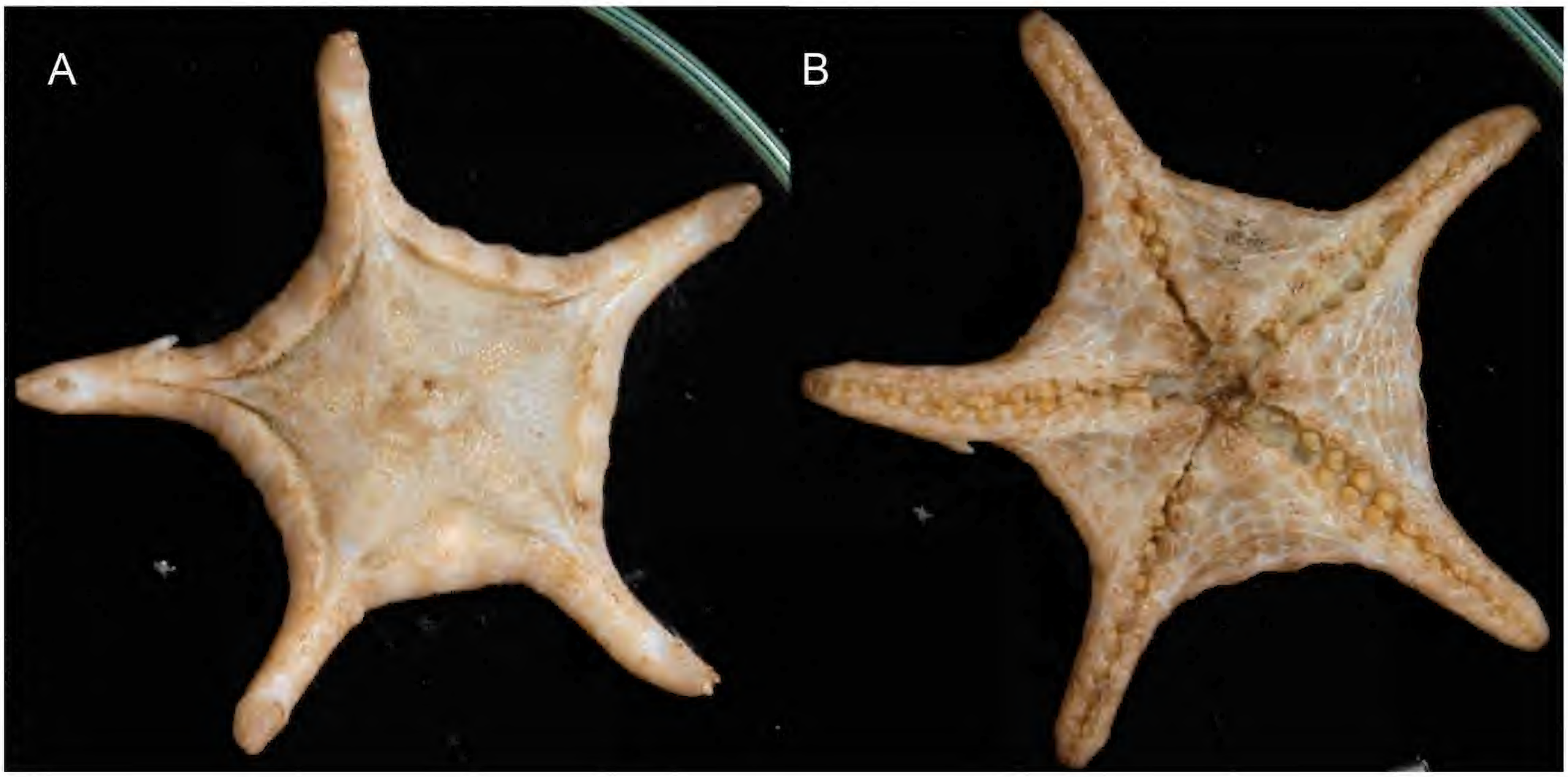


Figure 16. *Hyphalaster* sp. NMV F307758 (Op 120).

Diagnosis Characterized by superomarginals abutted along arm's length, unarmed. Cribiform organs 5-11, confined to interradial plates.

Taxonomic remarks Five species of *Hyphalaster* are currently recognized with species recognized from the Atlantic, Pacific, and Indian oceans as well as from the Antarctic region (Belyaev & Mironov, 1993). Although identification of this species remains ongoing, *Hyphalaster inermis* is one of the most widely distributed species with occurrence in the Indian Ocean. Based on the specimen collections, this is one of the most abundant species collected.

Distribution Globally: Atlantic, Pacific, Indian, Southern Ocean and adjacent. 2280–5430 m. IOT: Balthazar Seamount, Christmas Island off McPherson Point, Muirfield Seamount, Rudist Seamount, 2000–4047 m.

Ecology and life history Beyond the general knowledge for Porcellanasteridae, little is known regarding the specific biology or ecology of this species.

Sidonaster vaneyi **Koehler, 1909**

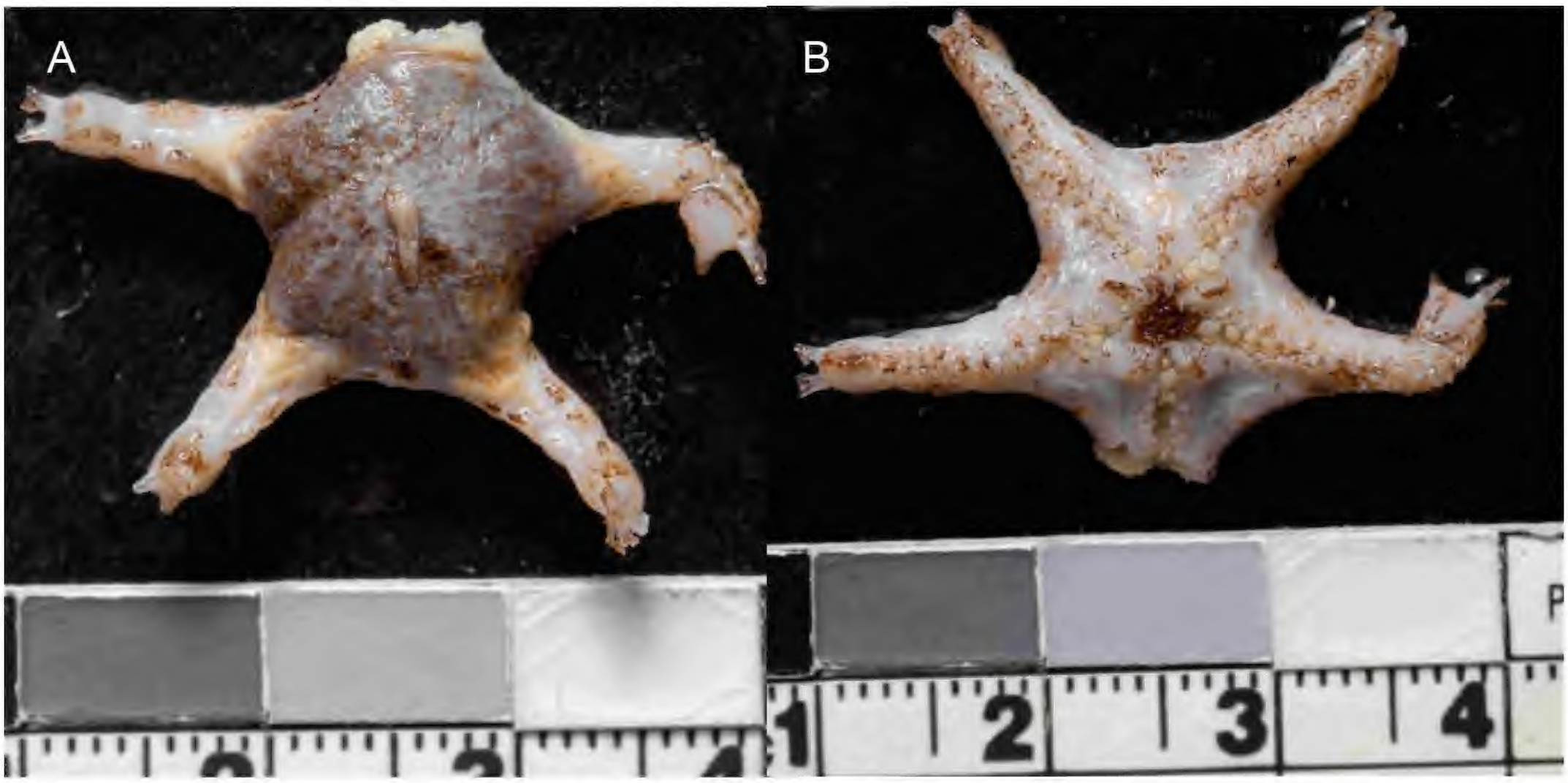


Figure 17. *Sidonaster vaneyi*. NMV F307806 (Op 196).

Diagnosis Superomarginals, each with a dorsal-facing spine, separated by abactinal plates along arm length to terminus. Single papilliform cribriform organ, with a single enlarged mouth spine. (*Sidonaster* is monotypic).
Taxonomic remarks A monotypic species.
Distribution Globally: Indian Ocean, east African coast to Malay Archipelago, the Philippines and New Guinea. 1147–2515 m. IOT: Cocos Abyssal, 3431–5414 m.
Ecology and life history Beyond the general knowledge for Porcellanasteridae, little is known regarding the specific biology or ecology of this species.

Styracaster horridus **Sladen, 1883**

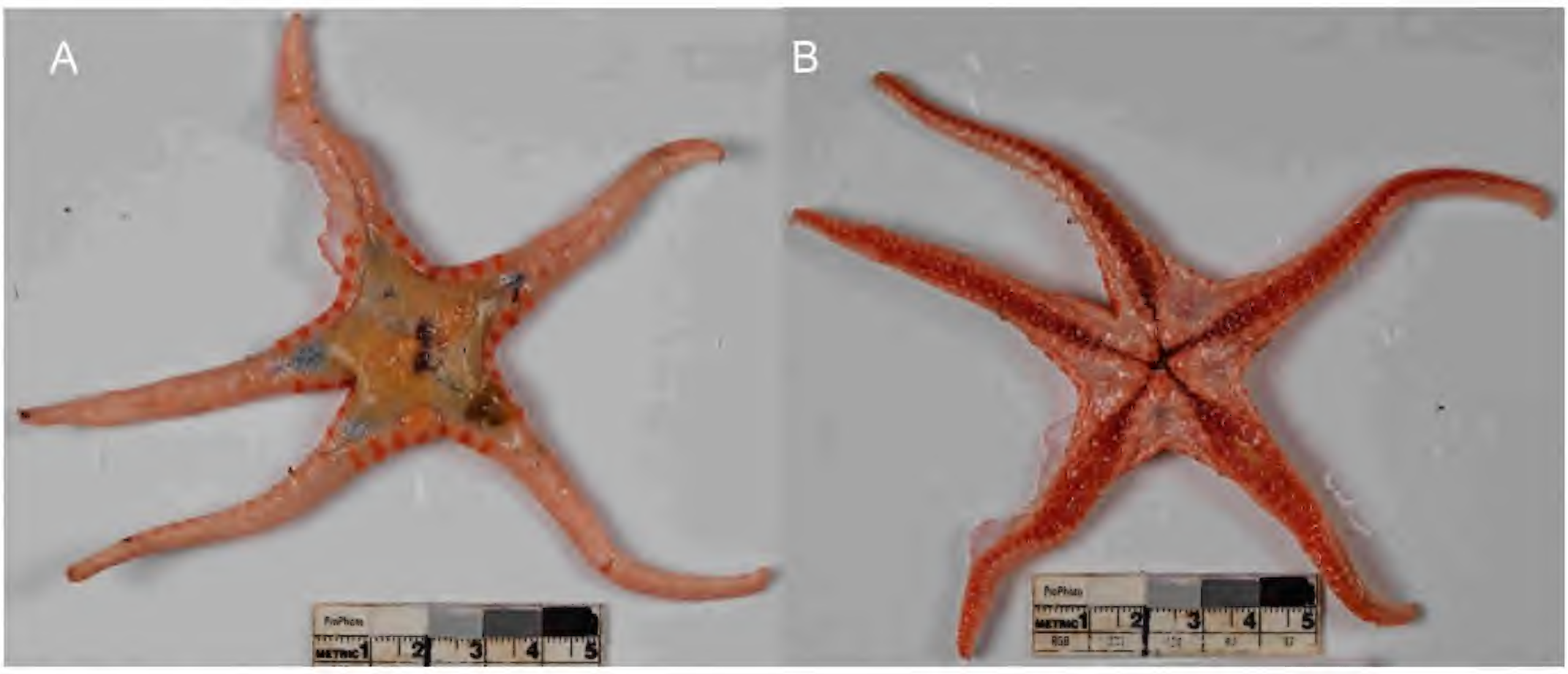


Figure 18. *Styracaster horridus*. NMV F307597 (Op 028).

Diagnosis Superomarginal plates abutted over midline, forming complete casing to arms. Prominent, erect spines present over midline but otherwise superomarginal plates unarmed. Cribiform organs, 3–11, present only on disk.
Taxonomic remarks A widely occurring genus containing 13 species which are distributed in the Atlantic, Pacific, Indian and Southern (Antarctic) oceans. This is the first Australian occurrence.
Distribution Globally: 2000-6000 m. IOT: Karma Seamount, Cocos Abyssal, Muirfield Seamount, Investigator Ridge Abyssal, Balthazar Seamount. 2760–5414.
Ecology and life history Beyond the general knowledge for Porcellanasteridae, little is known regarding the specific biology or ecology of this species.

***Pseudarchaster* sp.**

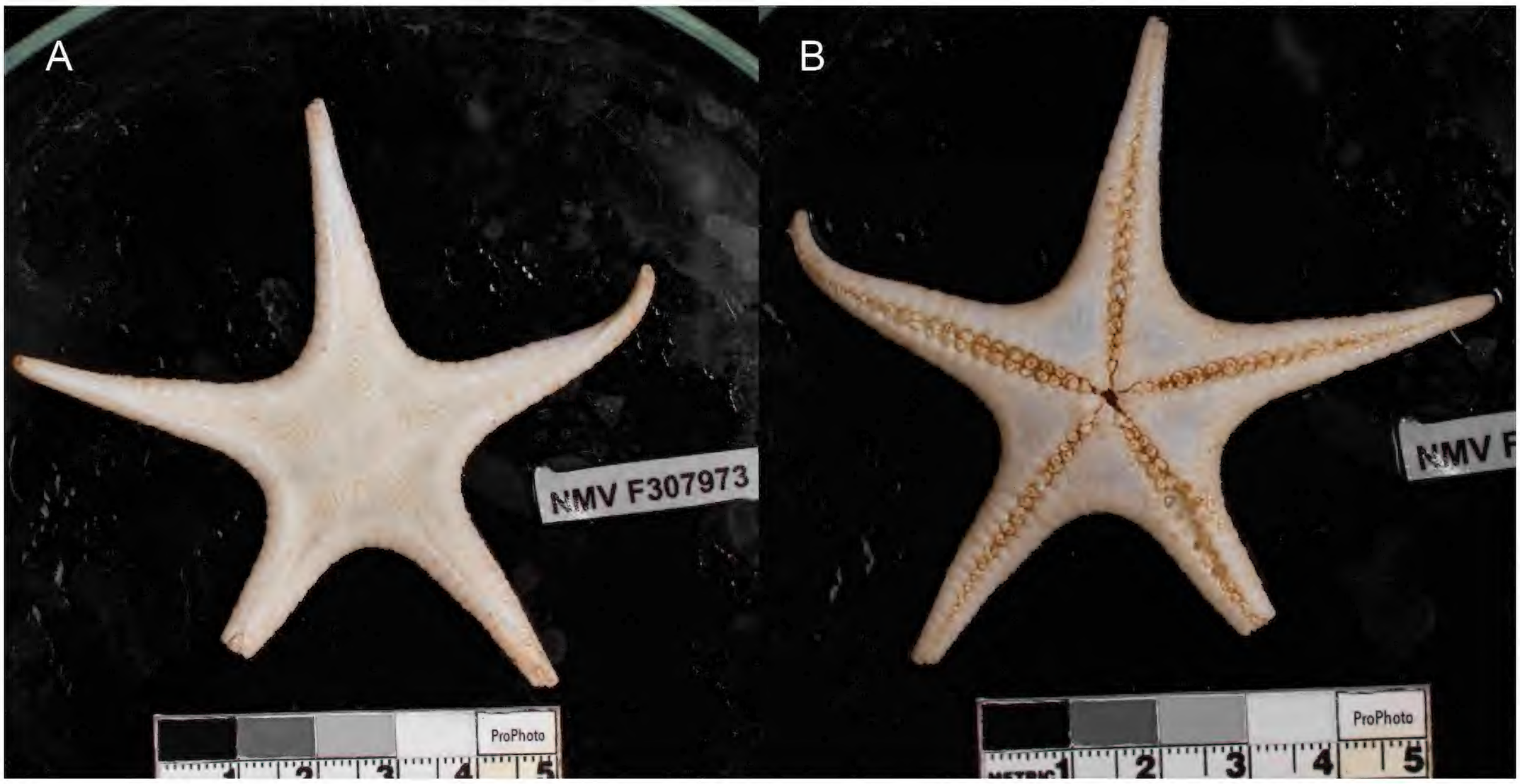


Figure 19. *Pseudarchaster* sp. NMV F307973 (Op 105).

Diagnosis Arms 5, body strongly stellate. Abactinal plates tabulate to paxilliform, present uniformly across disk and arms. Marginal plates broad, well-developed, surface covered by granules or spinets. Actinal plates in chevron formation. Tube feet flat or suckered.
Taxonomic remarks A genus including 21 living and 2 fossil species distributed widely throughout Pacific, Atlantic, Indian, and high-latitude oceans. Two species are recorded from Australian waters (Rowe & Gates, 1995). *Pseudarchaster* was historically classified within the Goniasteridae, but molecular phylogenetic data supported it as a member of the Paxillosida (Mah & Foltz, 2011). This placement also suggested that the other morphologically similar genera, such as *Paragonaster* are a distinct group.
Distribution Globally (for genus). Atlantic, Pacific, Indian Ocean, 75–3000 m. IOT. Balthazar Seamount, Clara Marie Seamount, 1554–2435 m.
Ecology and life history *Pseudarchaster* are poorly understood. Gut contents, especially of deep-sea specimens suggests they are deposit feeders or detritivores.

Order Valvatida

Family Asterinidae

Anseropoda sp.

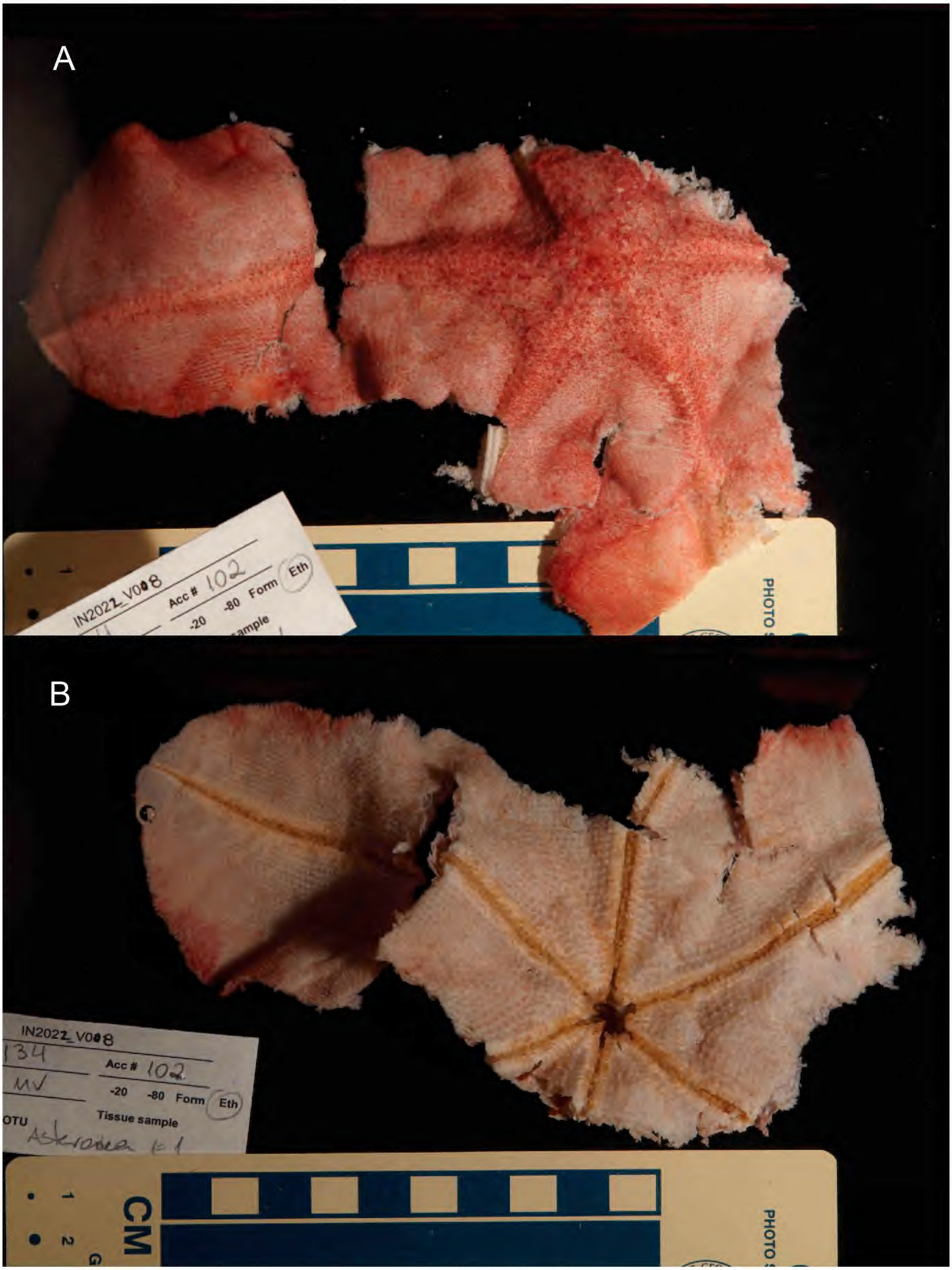


Figure 20. *Anseropoda* sp. 6 rayed specimen NMV F307697 (Op 134).

Diagnosis Rays 5—18 (6 arms in NMV F 307697); body very thin, margin variably curved, rays short or not discrete, broadly rounded or pointed; narrow raised radial areas with single papulae, in scattered or single longitudinal series, sometimes ringed by secondary plates; abactinal plates thin, in longitudinal and oblique series, not notched, each with subpaxilliform glassy, sacciform spinelets, few or tuft; pedicellariae over papulae; actinal plates in longitudinal and oblique series; actinal spines few to numerous per plate, glassy, sacciform; lacking superambulacral plates, superactinal plates present or absent; interradial plates meet internally by long thin articulating projections, extensive in interradii. From O'Loughlin & Waters (2004).

Taxonomic remarks *Anseropoda* includes 15 species present in the Atlantic, Pacific and Indian Oceans from shallow to deep depths, 0 to 300 m. Collected specimens are fragile and often badly damaged during collection. For example, the holotype of the Indian Ocean *Anseropoda ludovici* is an arm fragment with an absent disk. Although two species of *Anseropoda* are known from Australian waters, approximately six species are recorded from South Africa and the Indian Ocean. Most of these species are known from the holotype and singular, damaged specimens. Variation is poorly understood, making determination of this species dependent on further study.

Distribution Global (for genus), Atlantic, Pacific, and Indian Ocean, 0–600 m. IOT: Cocos (Keeling), 353–356 m.

Ecology and life history *Anseropoda* are unusual for their remarkably dorsoventrally compressed, and in some instances, paper thin bodies. Observation of shallow and deep-sea species (e.g. Marsh & Fromont (2020) & Chave & Malahoff (1998)) lying flush on sandy substratum. The shallow-water (0-145 m) multi-armed Australian species, *Anseropoda rosacea* has been reported as a scavenger as well as feeding on small echinoderms, crustaceans, and mollusks (Marsh & Fromont, 2020). The 6-armed species collected here possibly displays similar habits.

Family Caymanostellidae

***Caymanostella* sp.**

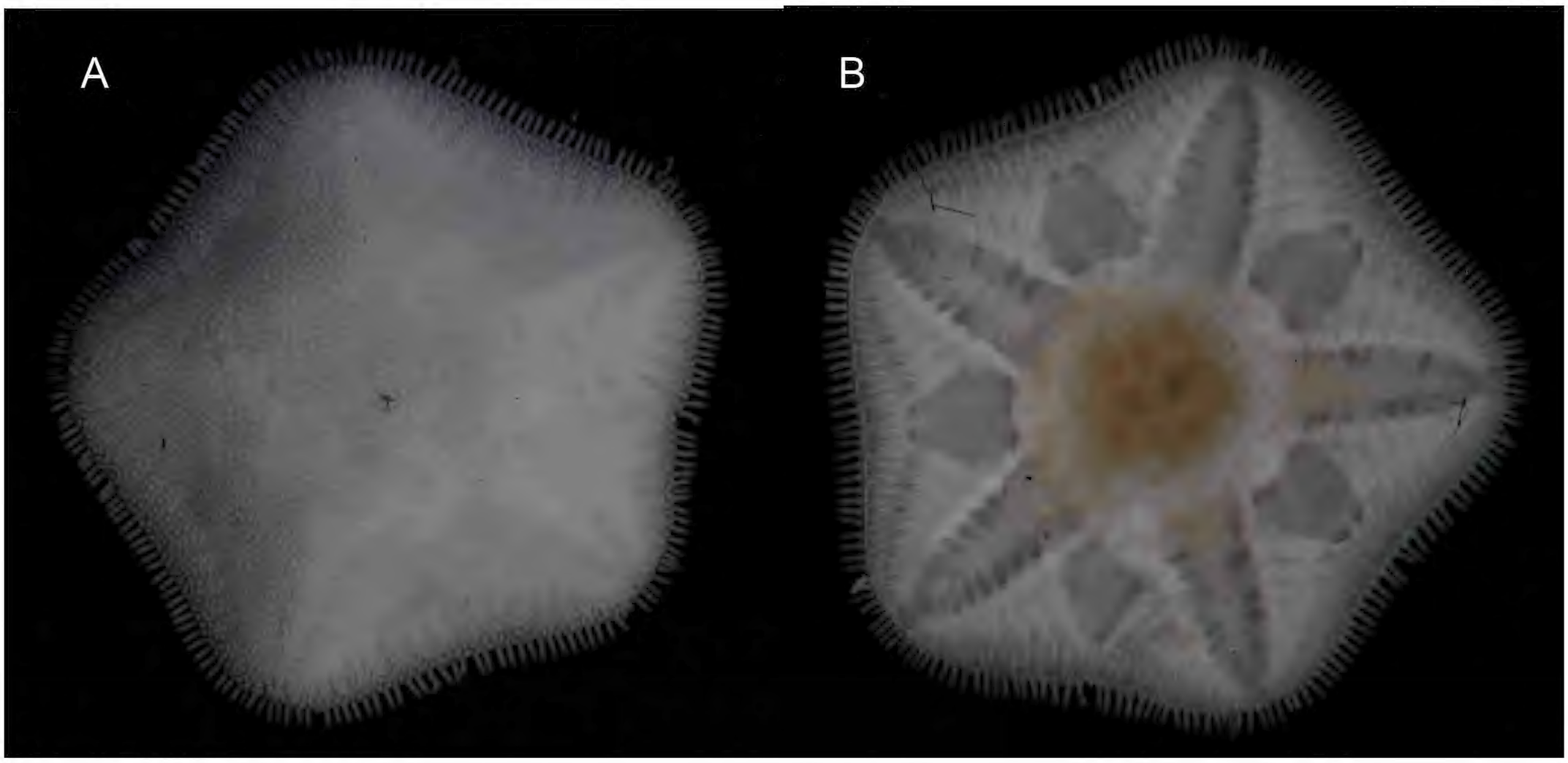


Figure 21. *Caymanostella* sp. NMV F307711 (Op 147).

Diagnosis Body shape hexagonal to fan-shaped. Abactinal plates lenticulate, granules present on plate surface, dermis not obscuring plate boundaries. Spinelets clavate, present around marginal periphery. Gonopores form notch on "aboral" edge of plate, or on "first" superomarginal Papulae absent. Modified from Belyaev (1974) & Rowe (1989).

Taxonomic remarks IOT: Cocos Keeling Island and Noel Seamount, 2671–3078 m.

Distribution IOT: Cocos Keeling Island and Noel

Seamount, 2671–3078 m.
Ecology and life history Although poorly understood, documented species of Caymanostella are present in deep-sea settings and live on the surface of deep-sea wood (summary in Dilman *et al.* (2021)) possibly feeding on wood-associated organisms.

Family Goniasteridae

***Astroceramus* sp.**



Figure 22. *Astroceramus* sp. NMV F307966 (Op 161).

Diagnosis Abactinal plates polygonal in outline, abutted, no surficial granules, surface smooth, bare. Crystalline nodules embedded in surface of abactinal plates. Marginal plates large, blocky, quadrate in outline, surface with coarse, surficial granules. Superomarginal plates abutted over midline variably from base of arm to paired distal penultimate plates. Actinal surface variably covered by coarse granules to bare. One to many large, thick subambulacral spines present in most species. Pedicellariae present or absent.
Taxonomic remarks A genus including 11 species distributed in the Pacific, Atlantic and Indian Oceans,

primarily in deep-water settings. Collection surveys indicate numerous specimens which suggest more species diversity than is currently recognized.
Distribution Globally (for genus): Atlantic, Pacific and Indian Oceans. IOT: Muirfield Seamount, 808–811 m.
Ecology and life history At least two Hawaiian species have been observed predating on various anthozoan species. *Astroceramus callimorphus* was observed feeding on caryophyllid corals and *Astroceramus eldredgei* was observed feeding on the gorgonian *Astromuricea* (Mah, 2015). Although species in *Astroceramus* are poorly understood, this suggests that this species might also be a predator on anthozoans.

***Atheraster umbo* Mah, 2024**

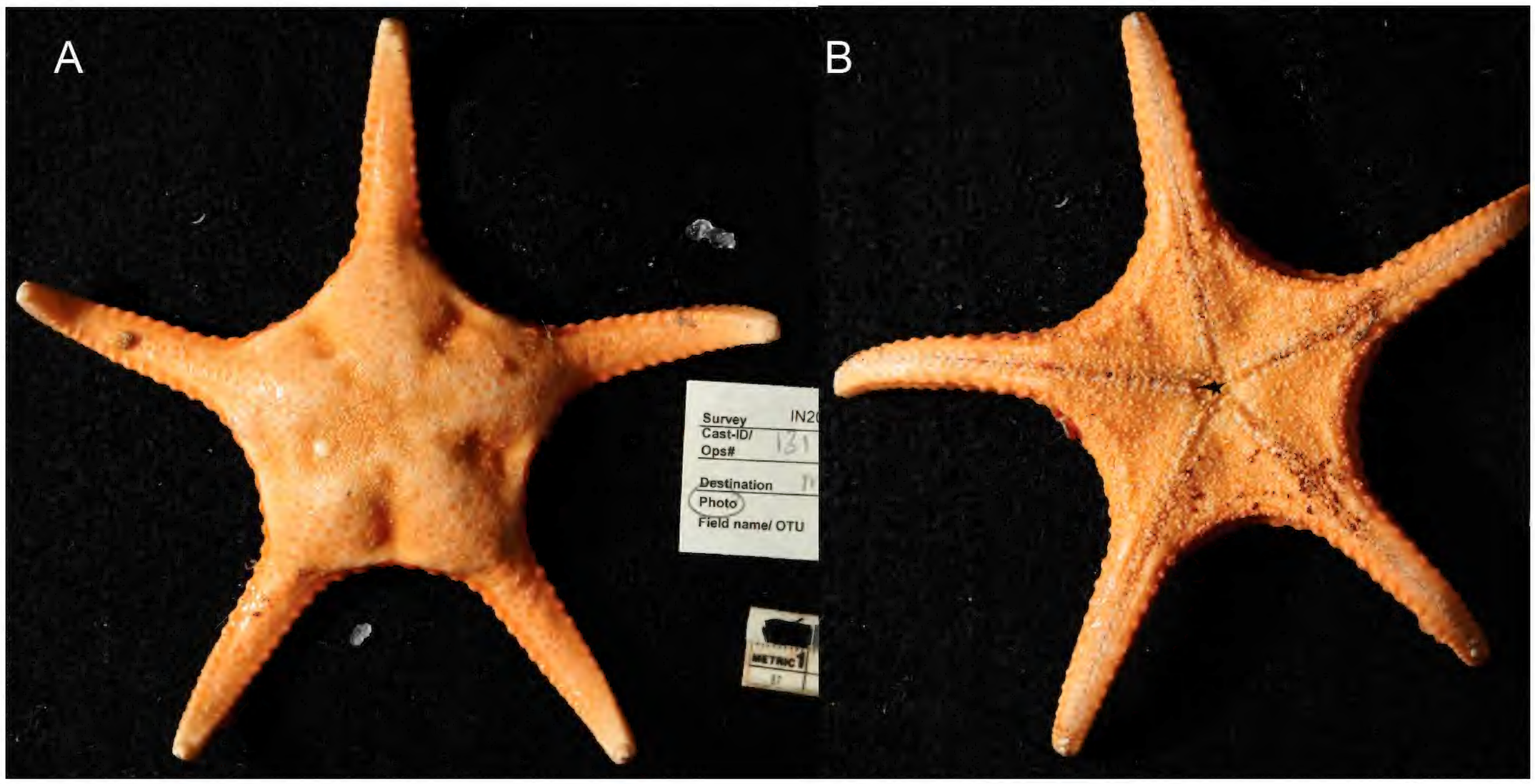


Figure 23. *Atheraster umbo*. NMV F307974 (Op 131).

Diagnosis Body stout, strongly stellate (R/r=3.2), arms elongate, triangular, interradial arcs weakly curved to straight. Abactinal plates irregular, bare, extending to armtip. Arm plates variably flat to strongly convex, acutely large relative to adjacent disk plates. Pedicellariae abundant, 4—12, along depression in each interradius. Five plates across proximally on arms decreasing to a single series to terminus. Marginal plates, 40-–44 per interradius, 20–22 per arm side, interradially with small granules/tubercles, 2 to 10 but otherwise smooth and bare. Marginal plates along the arms with single distinct tumescence. Granules, coarse nearly tubercular, most abundant interradially1—15, on marginal plates, decreasing, then absent along arm surface. Actinal plates with distinct alveolar pedicellariae flanked on either side by bisected hemispherical granules. Furrow spines 5—15, but mostly 7—8 with a prominent single tong-like pedicellaria with quadrate valves on each adambulacral plate, Spine, large thick, 2—3X the thickness of the furrow spines, identical in length to the longest of the furrow spines present at oblique angle to pedicellariae. Oral plates, each with large, paddle-shaped pedicellaria per plate, thus two per interradius, but not symmetrically positioned.
Taxonomic remarks Differs slightly from other *Atheraster* spp. in that it possesses tumescent projections on the marginals rather than full spines. It is apparently a wide-ranging species occurring in Tasmania and New Caledonia. This is its first occurrence in Australia.
Distribution Globally, Southeast Cape, Tasmania, Lord Howe Rise, New Caledonia. IOT: Cocos Keeling, 1373–1896 m.
Ecology and life history This species has only recently been described. Although in situ observations are not available, other *Atheraster* sp. are corallivores (Mah, 2022) and it is possible that this species is as well.

Bathyceramaster **sp.**

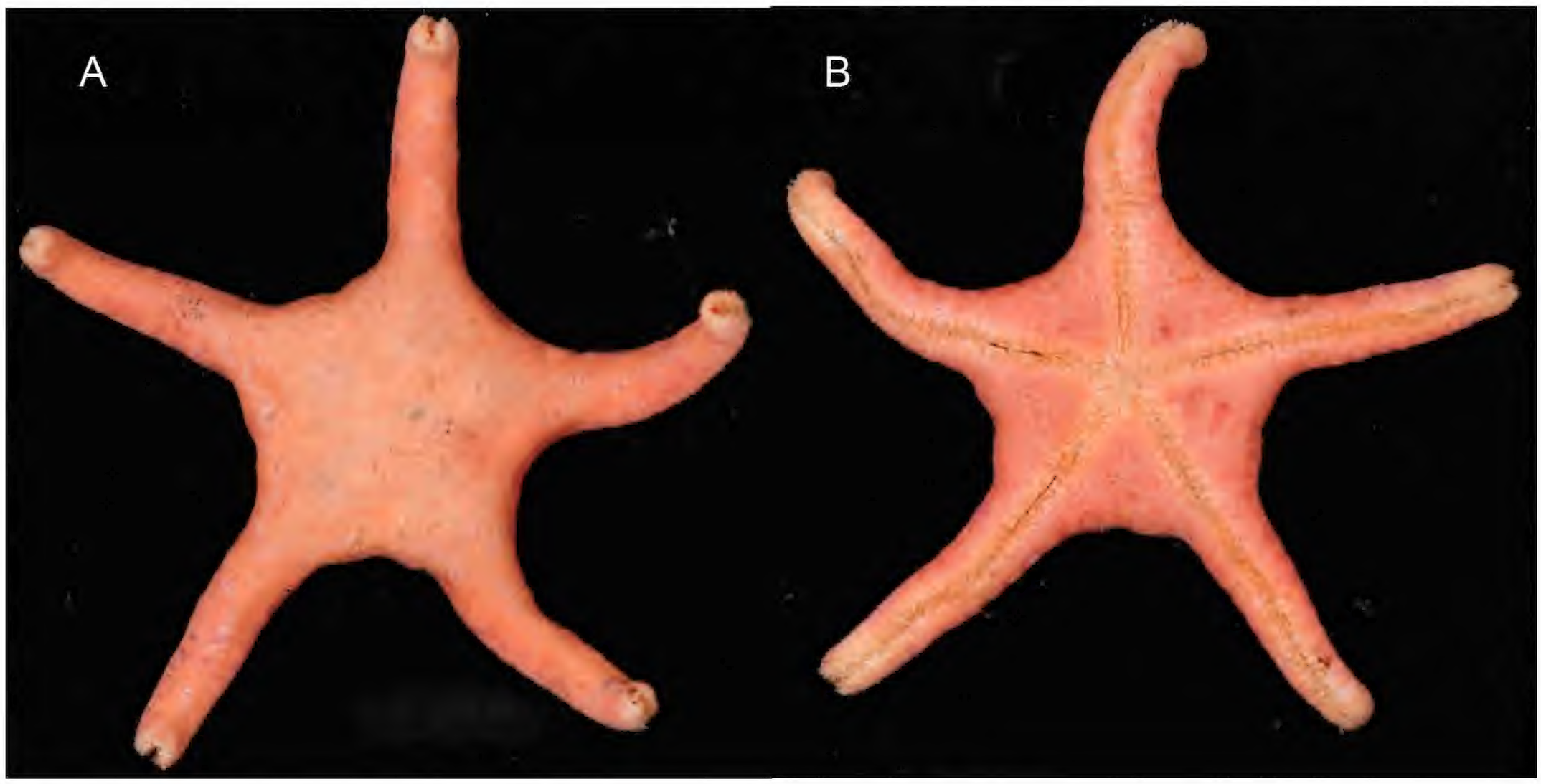


Figure 24. *Bathyceramaster* sp. NMV F 307965 (Op 187).

Diagnosis Abactinal plates tabulate, low to moderate in height with fasciolar grooves, variably shallow to well-developed, plates lacking stellate bases. Abactinal, marginal, actinal surfaces covered by densely arranged polygonal to round granules. Body stellate, many species with well-developed arms (R/ r=1.8—4.0). Based on Mah (2016).

Taxonomic remarks Five species of *Bathyceramaster* are known, primarily from the Pacific with one species known from the Atlantic. The account herein represents a new occurrence of this genus for the Indian ocean.

Distribution Globally (for genus). Present in the Atlantic, Pacific, Indian Oceans, 1165–4000 m. IOT. Southeast and Northwest Christmas Island, Clara Marie Seamount, Santa Ridge, 2189–2418 m.

Ecology and life history Little is known regarding *Bathyceramaster* sp. Some species, such as the Pacific *Bathyceramaster careyi* and others suggest they are predators of sponges in addition to scavenging (Mah, 2016, 2018).

Ceramaster sp.

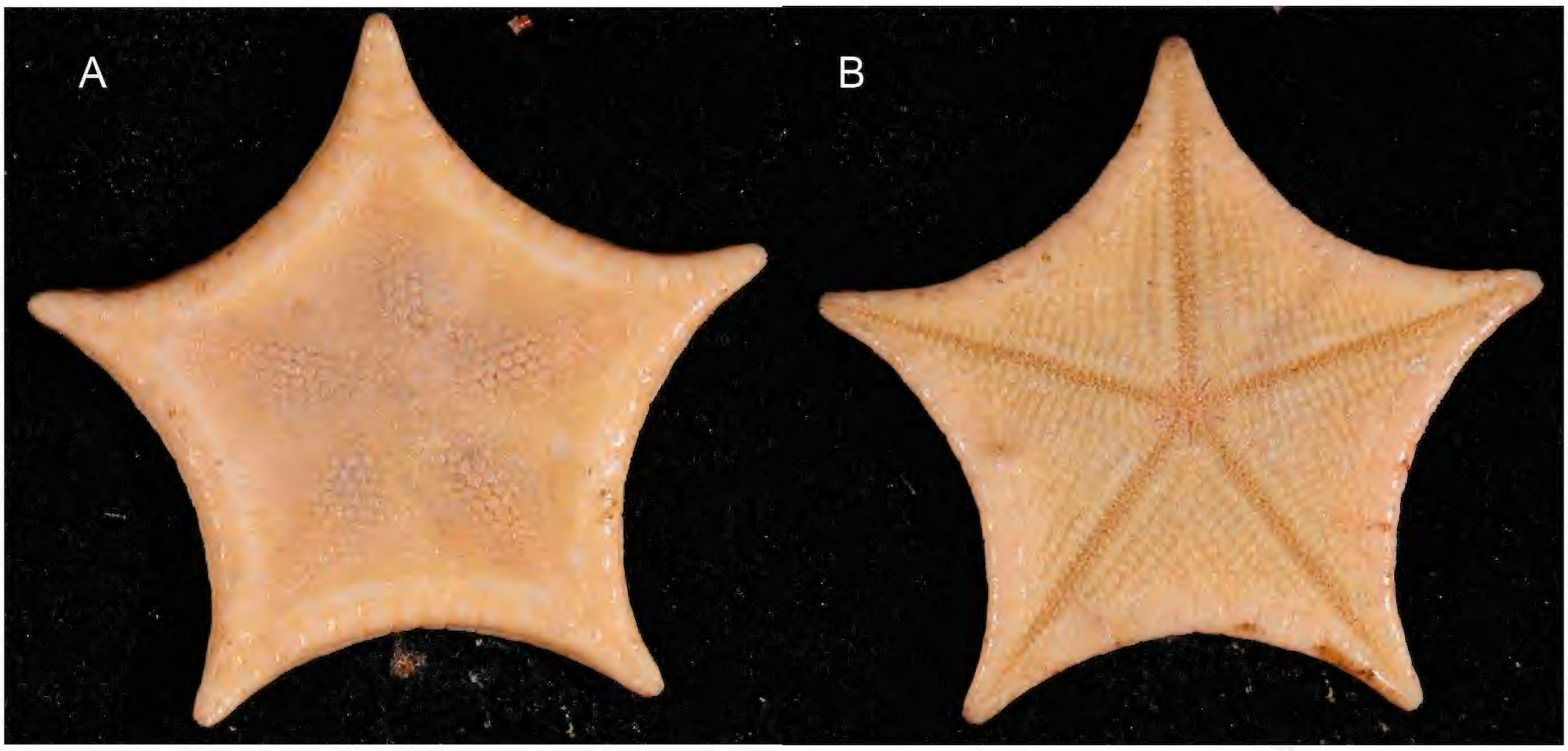


Figure 25. *Ceramaster* sp. NMV F307959 (Op 143).

Diagnosis Arms 5, body outline pentagonal in most (i.e., R/r=1.1-–1.5) with some becoming more stellate. Abactinal plates tabulate, granules present on abactinal plates, marginals, actinal plates. Peripheral granules around radial regions narrow, rectangualr. Fasciolar grooves present among abactinal, marginal plates. Approximately 20 superomarginal plates per interradius, arm tip to arm tip. Elongate Bare "patch" on dorsal facing of superomarginal plates.

Taxonomic remarks *Ceramaster* includes 15 living species present in the Atlantic, Pacific and Indian Oceans. It is unclear if *Ceramaster* is monophyletic as other taxa, such as *Peltaster* and *Sphaeriodiscus* display overlapping morphological characters and different species within *Ceramaster* have met with contentious classification, as evidenced by Clark & Downey (1992) attempt to assign numerous species, such as *Ceramaster patagonicus* as subspecies of *Ceramaster grenadensis*. One species of *Ceramaster* is recorded from the Indian Ocean and one species, *Ceramaster patagonicus* is recorded from Australian waters.

Distribution Global (for genus): Atlantic, Pacific, Indian. IOT: Cocos (Keeling) Island, 1113 m.

Ecology and life history Some species of *Ceramaster*, such as *Ceramaster vorax*, have been observed as predators on sponges with others displaying similar habits (Mah, 2020). It is unclear however, if the taxonomic issues surrounding this group may determine if differing feeding habits and/or preferences are assignable to different lineages of *Ceramaster* spp.

Evoplosoma timorensis **Aziz & Jangoux, 1985**

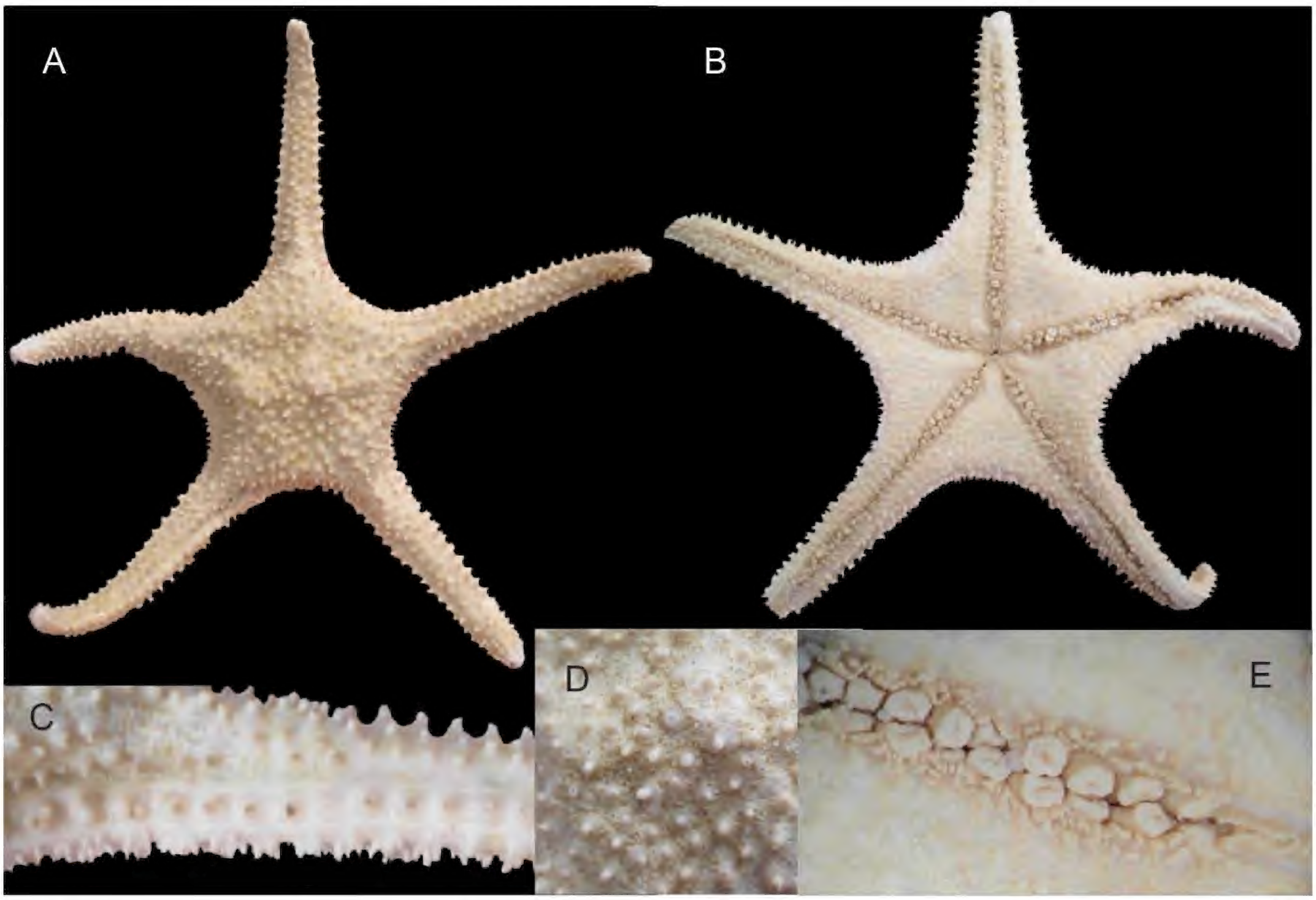


Figure 26. *Evoplosoma timorensis*. NMV F307986 (Op 143).

Diagnosis Body shape strongly stellate (R/r=3.5-–4.0), arms elongate, interradial arcs rounded. Abactinal, marginal, actinal plate surfaces covered by thickened dermis invested with granules. Abactinal surface bearing spines, large, variably blunt tipped to conical. Superomarginal plates mostly with conical spines, 1—2, inferomarginals with shorter, variable spines, 4—5; all spines with rough tips in addition to smaller secondary spines. Actinal surface covered by granule-invested dermis, thorny spinelets, 1—3. Furrow spines, 5—8, in angular arrangement, blunt tipped. quadrate in cross-section.

Taxonomic remarks This is the first occurrence of this species in Australian waters. Other observed individuals of this species show similar if much differently spaced or more or less numerous abactinal and marginal spination. Body and arm shape also vary across its range with some individuals showing a much more strongly arched disk.

Distribution Globally. Solomon Islands, Wallis and Futuna Islands, Tahiti/Tuamoto, Papua New Guinea, East Timor Region and Celebes Sea, Indonesia. 795—1279 m. IOT: Cocos Keeling Islands, 932—965m.

Ecology and life history Although there are no published images of *Evoplosoma timorensis* feeding, most other *Evoplosoma* species have been observed predating on various octocorals, notably isidid or bamboo corals (e.g. Mah, 2015, 2020, 2022) and it seems likely that it does as well.

Mediaster roanae Mah, 2018

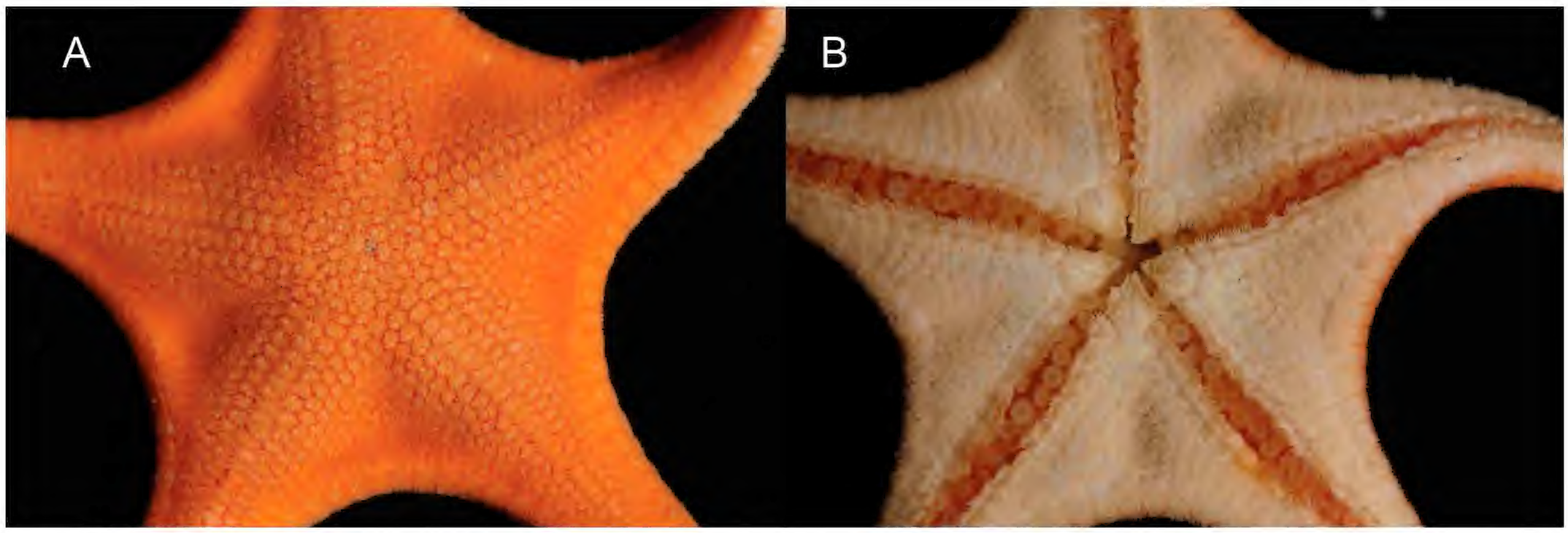


Figure 27. *Mediaster roanae*. NMV F307964 (Op 128).

Diagnosis Body size strongly stellate (R/r=3.0 to 3.6). Abactinal plates with granular cover composed of pointed, cylindrical-shaped granules, seven to 60. Coarse, larger granules present centrally, numbering 15–25. Abactinal plates with distinctive radiating bar-shaped plates on each plate base. Superomarginals with lateral facing interradially, becoming more upwards facing distally. Marginal plates 74–82 per interradius (37–41 per side at R=9.1 cm), granules on marginal plates pointed. Tong-like pedicellariae not observed on abactinal surface but present on marginal and actinal surfaces. Furrow spines seven to 12, 10–12 proximally. This species distinguished by pointed actinal granules.

Taxonomic remarks *Mediaster* includes approximately 18 species present throughout the Atlantic, Pacific, and Indian Oceans. A total of five species *Mediaster* are currently recorded from the Indian Ocean, 256-1630 m (Mah, 2018).

Distribution Globally. Madagascar, 379—416 m. IOT: Northwest and southwest of Christmas Island, Cocos (Keeling) Island, 328–554 m.

Ecology and life history Little is known regarding the biology or ecology of this species. Other species of *Mediaster* are thought to be scavengers and detritivores (Jangoux, 1982).

Plinthaster lenaigae **Mah, 2018**



Figure 28. *Plinthaster lenaigae*. NMV F307967 (Op 159).

Diagnosis Body pentagonal to weakly stellate (R/r=1.0 to 2.0), interradial arcs weakly curved to straight. Abactinal plates flat, bare, smooth with no surficial accessories, but crystalline nodules/tubercles or radiating patterns embedded in plate subsurface. A single row of peripheral granules present around plates. Marginal plates 6 total per interradius, 2 enlarged pre-terminal superomarginals, 4 remaining, each with widely spaced coarse granules but otherwise smooth or bare. Actinal surface covered by granules. Modified from Mah (2018).

Taxonomic remarks *Plinthaster* is easily mistaken for several other goniasterid "cookies", i.e. other genera with similar pentagonal appearance. *Ceramaster*, *Peltaster*, and *Sphaeriodiscus* all demonstrate granule-covered tabulate or shallow tabulate abactinal plates. *Eknomiaster*, *Glyphodiscus* and *Iconaster* can be superficially similar but lack the crystalline nodules/tubercles embedded in the abactinal plate subsurface. *Glyphodiscus* and *Iconaster* are more strongly stellate. *Eknomiaster* has more strongly tumid superomarginal and abactinal plates as well as many more or larger pedicellariae on the actinal surface. *Astroceramus* shares the same type of flattened, polygonal abactinal plates with bare surfaces and crystalline nodules that are present in *Plinthaster* but displays a much more strongly stellate shape and differing types of adambulacral spination.

Distribution Globally (genus): Madagascar and western Indian Ocean, 560–833 m. IOT: Muirfield Seamount, 603–808 m.

Ecology and life history Little is known regarding the biology or ecology of this species. In situ observations of the Atlantic *Plinhthaster dentatus* shows this species as a predator on sponges, suggesting that *Plinthaster lenaigae* may feed in a similar fashion.

Sibogaster nieseni Mah, 2016

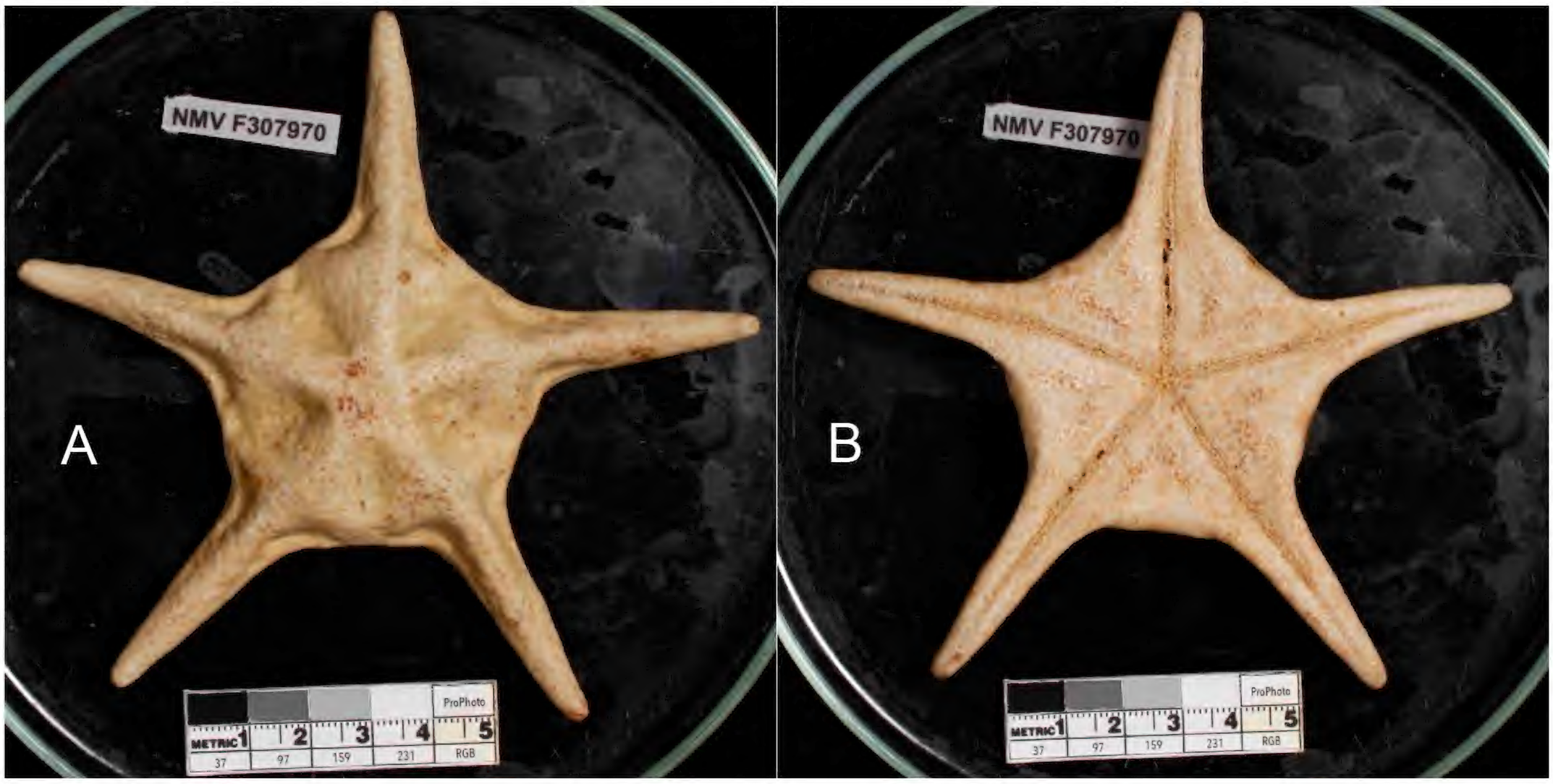


Figure 29. *Sibogaster nieseni*. NMV F307970 (Op 103).

Diagnosis Body stellate (R/r=1.88 to 3.0), disk thick, arms elongate. Interradial arcs weakly curved to straight. Abactinal surface composed of small, abutted plates, flat to weakly convex, surface smooth and devoid of surficial accessories (granules, etc.). Surface level with superomarginal plate boundary. Plates abundant on disk and proximally on arms, decreasing to a single row on arms. Glassy tubercles absent from disk surface. Peripheral granules large, taking up 20–30 % of plate+granule diameter. Marginal plates wide to quadrate in shape, approximately 28 to 46 at R-4.0 to 5.0. Superomarginal and lateral face of inferomarginal plates flat with no surficial accessories. Actinal surface of inferomarginals with granules. Actinal plates abutted, quadrate in shape, covered by granules, coarse, hemispherical. Furrow spines 6-10, blunt, quadrate in cross-section, subambulacrals 3-5 separated from one another by discrete space. Pedicellariae, 1–2, tong-like, adjacent to adambulacral spination. Color in life orange to deep-red.

Taxonomic remarks This species is closely related to a second Atlantic species *Sibogaster bathyheuretor*. Further work is in progress that will place these two species into a separate genus.

Distribution Globally. Widely occurring in the North Pacific, Taney Seamounts and NESCA clam sites, Indonesia, Celebes Sea, and Atlantic, off Mauritania, 2100-4175 m. IOT. Balthazar Seamount, Santa Ridge, Gulf of Gascoyne, 2156–3510 m.

Ecology and life history Little is known regarding the biology of this species. Mah (2020) recorded feeding behavior of the Atlantic species *Sibogaster bathyheuretor*, which suggests that it is either a detritivore and/or a predator on epizoic organisms, such as sponges.

Family Solasteridae

***Lophaster* sp.**

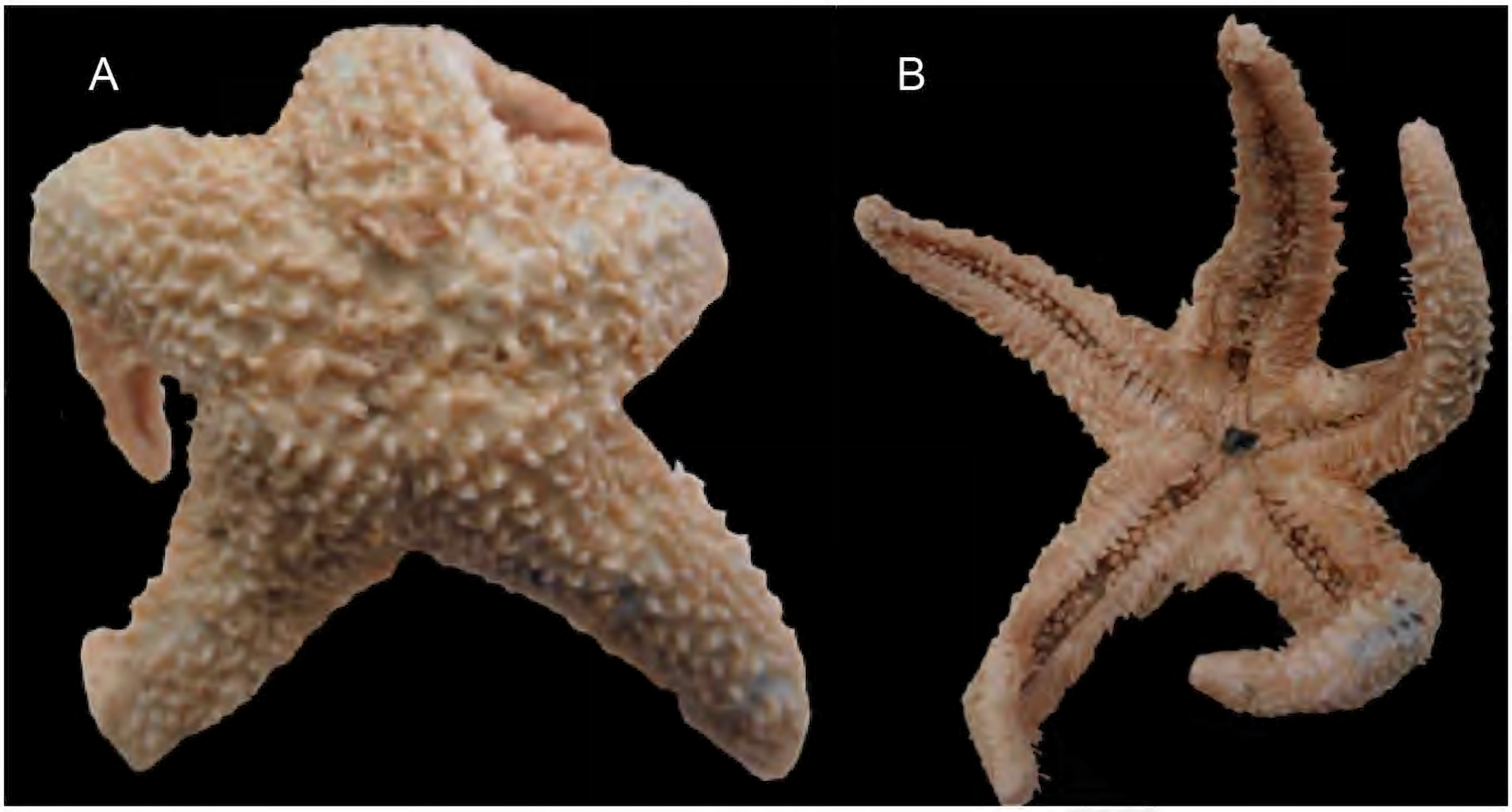


Figure 30. *Lophaster* sp. NMV NMV F307586 (Op 005).

DiagnosisArms five, cylindrical in cross-section, interradial arcs acute. Abactinal skeleton reticulate, papular areas with multiple pores. Abactinal plates paxillate. Marginal plates in two series, composed of distinct paxillae, larger than adjacent abactinal plates. One series of actinal plates, extending along arm in most species.

Taxonomic remarks Ten species of *Lophaster* are known from cold and temperate water settings from shallow to deep-sea settings in the Pacific, Atlantic, and the Antarctic. The *Lophaster* reported here is a new occurrence for the Indian Ocean. However, some Lophaster species, such as the North Pacific *L. furcilliger* and the North Atlantic *L. furcifer* show relatively few character differences suggesting widespread species and this could be the case for those in this region. There have been no prior accounts of *Lophaster* from Australian waters (Rowe & Gates, 1995).

Distribution Globally (for genus): Widespread, Pacific, Atlantic and high-latitudes (Antarctic and adjacent). IOT: Southeast Christmas Island, 643 m.

Ecology and life history *Lophaster* are poorly studied relative to their mutli-armed relatives in the genus *Solaster*. Gut contents (summary in Jangoux, 1982) and in situ observations suggest predation on comatulid crinoids and other benthic echinoderms, such as brittle stars.

Order Velatida

Family Pterasteridae



Figure 31. Osculum from *Hymenaster echinulatus*, Great Australian Bight, BEAMT-052, Acc. 119.2.

Diagnosis Arms five to eight. Body variably pentagonal to stellate, endoskeleton weakly developed in many species. Abactinal skeleton reticulate, weakly developed, covered by a distinct supra dorsal membrane which obscures the abactinal surface, save for a central opening called the osculum. This membrane is variably soft and fleshy to fibrous and thick, supported by paxillae present on the abactinal surface. Tube feet two to four.

Taxonomic Remarks The Pterasteridae includes seven extant genera that occur in primarily deep-sea or cold-water habitats. One genus, *Euretaster*, is known from shallow-water depths, 0–132 m. *Pteraster*, is represented by two species from deep-sea depths, 65-308 m. Although not published, at least 2 to 4 species in the genus *Hymenaster* are definitively present in Australian waters from relatively deep-water settings. (>500 m). Genera in the Pterasteridae are often collected in badly damaged condition by trawl net collection which can create difficulties in making conclusive identifications.

***"Hymenaster"* sp.**

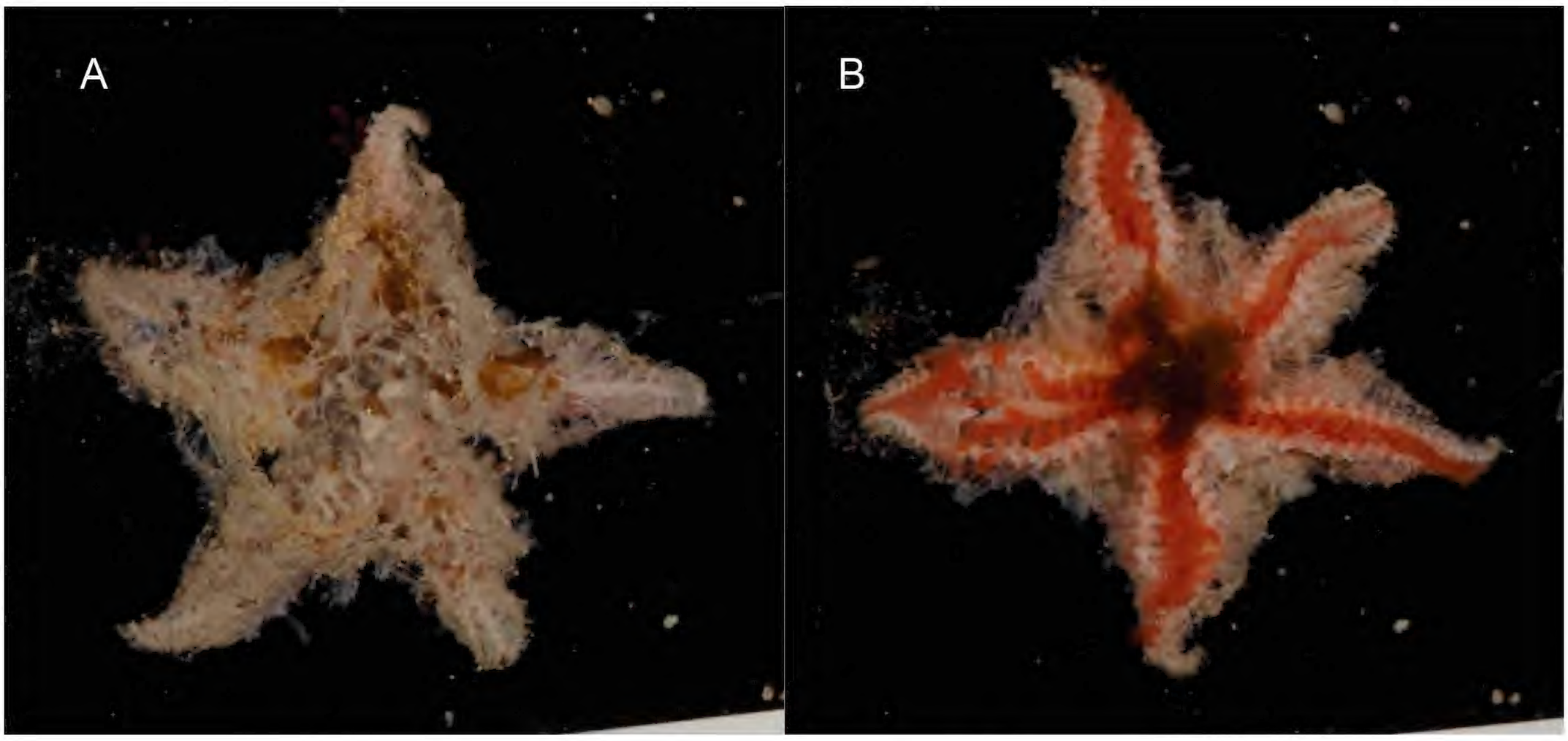


Figure 32. *"Hymenaster"* sp. NMV F307727 (Op 143).

Diagnosis (For the genus): Arms 5, body pentagonal to weakly stellate. Supradorsal membrane variably thin and transparent to parchment-like to fleshy or gelatinous with bands of muscular fibers and few to many spiraculae. Central osculum large, well-developed. Paxillae restricted to radial regions; actinolateral spines embedded in and supporting broad actinal membrane. Adambulacral spines few, unwebbed (but can be ensacculate); segmental apertures covered by opercula. Mouth plates broad, keeled with spines. Tube feet biserial. Based on Clark & Downey (1992). (For the specimen): Arms 5, body weakly stellate (R/r=1.5), supra dorsal membrane and abactinal skeleton badly damaged. Actinolateral spines present. Adambulacral (furrow spines) unwebbed. Biserial tube foot rows. All specimens examined were small with none greater than 2.0 cm diameter.

Taxonomic remarks Identification of these specimens was problematic. While the specimens provisionally meet the definition of *Hymenaster*, in that they show evidence of a supradorsal membrane and unwebbed adambulacral spines, this latter character is difficult to assess owing to the possibility of collection damage and the small size of the specimens, which has also damaged characters on the disk and arms. The supra dorsal membrane in *Hymenaster* varies across species, with some taxa showing coverings that range from fibrous and thick to transparent or even gelatinous with paxillar spines emerging into its surface. *Hymenaster* includes approximately 50 species which occur in all of the world's oceans, primarily in deep-sea and high-latitude settings. Species in this group are, in many instances, known from single specimens, fragile, and collected from great depth. Clark (1989a) has commented on the need to re-examine these species in light of the morphological variation of known widespread species. *Hymenaster* has not been previously documented from Australian waters

Distribution Globally (for genus), Atlantic, Pacific, Indian, Southern, Arctic, 405–5300m. IOT: Christmas Island off McPherson Point, Cocos (Keeling) Island, Muirfield Seamount, Southwest Cocos Island, 477–1343 m.

Ecology and life history Different *Hymenaster* spp. are a common sight on many deep-sea video cruises based on multiple submersible videos, especially in the Atlantic and the Pacific. Although observed on multiple substrates at variable depths, relatively little is known regarding the biology and ecology of the observed subjects. Gut contents and miscellaneous accounts (Jangoux, 1982) suggest *Hymenaster* species feed on sediment to a range of bottom food, including bivalves to echinoderm fragments, but feeding has never been observed. Pain *et al.* (1982) have reported on the reproductive biology of the Atlantic *Hymenaster membranaceus*.

***"Pteraster"* sp.**

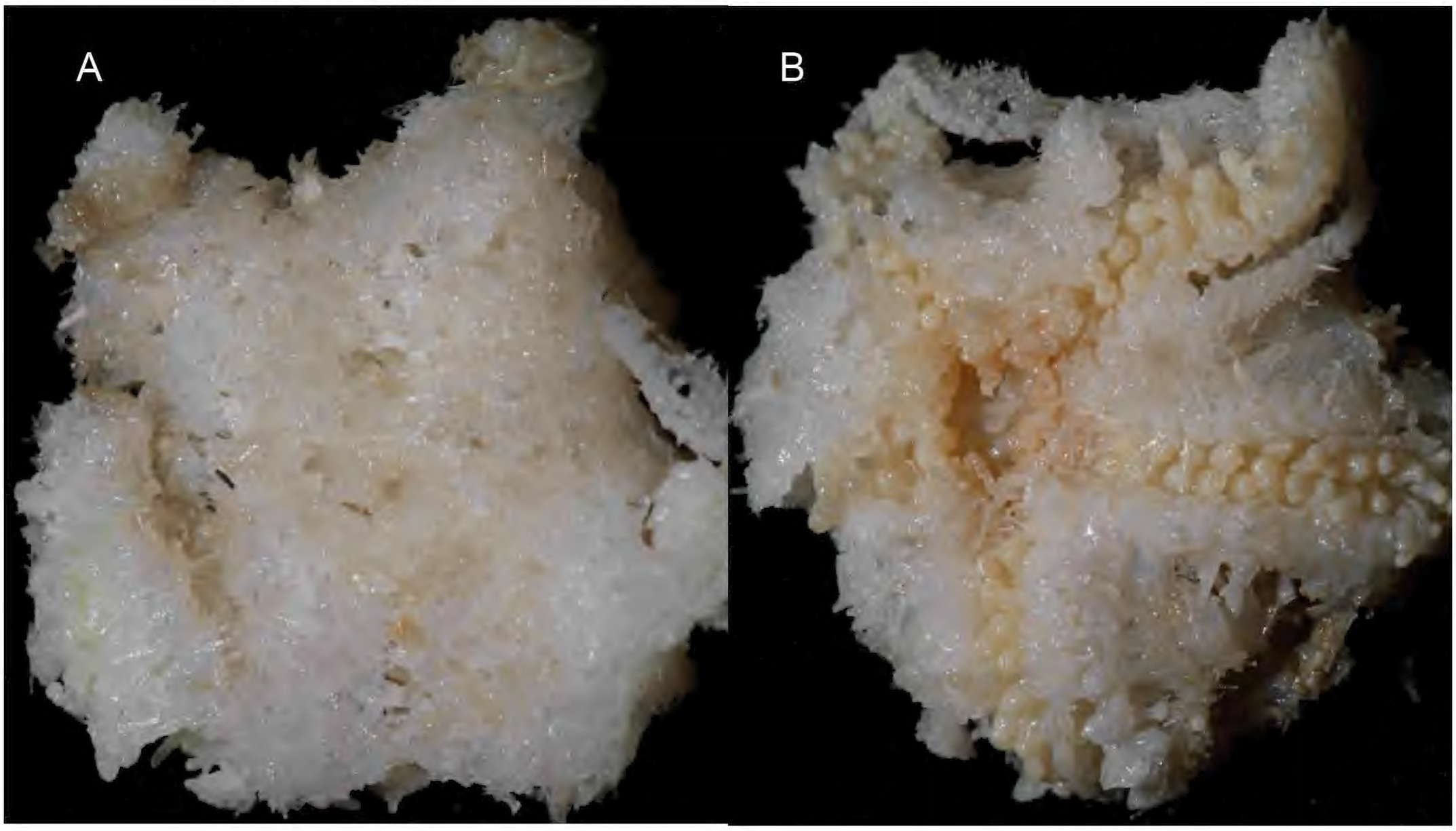


Figure 33. *"Pteraster"* sp. NMV F307722 (Op 193).

Diagnosis(For genus). Arms 5 to 6, body pentagonal to weakly stellate. Supradorsal membrane variably thick to weakly developed. Body thick, overall shape strongly arched. Actinolateral membrane narrow or not projecting much beyond ambitus. Adambulacral spines webbed in transverse series. Tubefeet, 2 to 4 rows. Based on Clark & Downey (1992) & McKnight (2006). (For material) Arms 5. Supradorsal membrane weakly expressed or damaged. Biserial tube foot rows. Body red to orange. Adambulacral spines webbed.
Taxonomic remarks A single specimen with what appears to be a badly damaged or absent supradorsal membrane. Membranes between the adambulacral spines were observed. Two species of *Pteraster* are documented from Australia (Rowe & Gates, 1995). It is unclear that this specimen is either of those.
Distribution Globally (for genus). IOT: SW Cocos Island, 467–477 m.
Ecology and life history *Pteraster* includes approximately 48 living species distributed throughout all the world's oceans, including the Arctic and Antarctic with 4 fossil species. Two species, *P. obesus* and *P. tetracanthus* are recorded from Australian waters from moderately deep-water, 65-308 m. Many species of *Pteraster* are present at great depth with some species present at > 4000 m. Although prey items for most *Pteraster* species are poorly understood, many are thought to be predators on sponges (e.g.Mauzey & Dayton (1968)). Some species of *Pteraster* are known by the common name "Slime Stars" owing to the ability of the North Pacific *Pteraster tesselatus* to produce prolific amounts of mucus as a defense mechanism against predators, notably the echinoderm predator *Solaster dawsoni* (Nance, 1979). It is unclear how many species of *Pteraster* possess this ability. At least one species, *Pteraster militaris* broods juveniles in its supra dorsal membrane and other species may possibly do so as well (McClary & Mladenov, 1990).

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Species name	Family	Order	Operation	Accession no	Num	Reg. no.*
Hymenodiscus sp.	Brisingidae	Brisingida	IN2021_V04 033	122	1	NMV F307602
Hymenodiscus sp.	Brisingidae	Brisingida	IN2021_V04 050	129	28	NMV F307712
Hymenodiscus sp.	Brisingidae	Brisingida	IN2022_V08 126	132	1	NMV F307714
Hymenodiscus sp.	Brisingidae	Brisingida	IN2022_V08 138	104	1	NMV F307716
Hymenodiscus sp.	Brisingidae	Brisingida	IN2022_V08 145	158	1	NMV F307713
Hymenodiscus sp.	Brisingidae	Brisingida	IN2022_V08 161	141	1	NMV F307715
Hymenodiscus sp.	Brisingidae	Brisingida	IN2022_V08 181	132	1	NMV F307719
Hymenodiscus sp.	Brisingidae	Brisingida	IN2022_V08 181	165	1	NMV F307720
Hymenodiscus sp.	Brisingidae	Brisingida	IN2022_V08 181	166	1	NMV F307721
Hymenodiscus sp.	Brisingidae	Brisingida	IN2022_V08 196	118	1	NMV F307718
Freyella sp.	Freyellidae	Brisingida	IN2022_V08 122	201	1	NMV F307717
Coronaster sp.	Asteriidae	Forcipulatida	IN2022_V08 163	179	1	NMV F307698
Coronaster volsellatus	Asteriidae	Forcipulatida	IN2022_V08 172	111	1	NMV F307699
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2021_V04 031	112	4	NMV F307600
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2021_V04 037	139	1	NMV F307622
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 105	152	1	NMV F307702
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 105	153	1	NMV F307705
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 116	108	1	NMV F307989
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 131	106	3	NMV F307625
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 131	106	1	NMV F307627
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 153	105	1	NMV F307707
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 153	108	1	NMV F307990
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 153	148	1	NMV F307708
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 153	152	1	NMV F307991
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 153	153	1	NMV F307992
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 185	102	1	NMV F307703
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 185	117	1	NMV F307706
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 189	120	1	NMV F307700
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 189	121	1	NMV F307701
Zoroaster sp.	Zoroasteridae	Forcipulatida	IN2022_V08 189	122	1	NMV F307704
Benthopecten sp.	Benthopectinidae	Notomyotida	IN2021_V04 031	106	4	NMV F307626
Benthopecten sp.	Benthopectinidae	Notomyotida	IN2021_V04 031	124	3	NMV F307620
Benthopecten sp.	Benthopectinidae	Notomyotida	IN2021_V04 031	125	20	NMV F307601
Benthopecten sp.	Benthopectinidae	Notomyotida	IN2021_V04 040	112	1	NMV F307608
Benthopecten sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	154	1	NMV F307896
Benthopecten sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	155	1	NMV F307870
Benthopecten sp.	Benthopectinidae	Notomyotida	IN2022_V08 196	134	4	NMV F307807
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2021_V04 012	113	1	NMV F307592
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2021_V04 013	111	1	NMV F307593
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2021_V04 035	118	1	NMV F307603
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2021_V04 037	136	5	NMV F307604
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2021_V04 037	138	15	NMV F307605
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2021_V04 050	129	28	NMV F307612
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2021_V04 053	109	4	NMV F307614
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	116	38	NMV F307919
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	117	1	NMV F307869
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	227	1	NMV F307920
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	228	1	NMV F307921
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	229	1	NMV F307922
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	230	1	NMV F307923
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	231	1	NMV F307924
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	232	1	NMV F307925

Species name	Family	Order	Operation	Accession no	Num	Reg. no.*
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 105	233	1	NMV F307926
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 111	111	1	NMV F307874
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 113	148	1	NMV F307878
Cheiraster sp.	Benthopectinidae	Notomyotida	IN2022_V08 113	149	1	NMV F307868
Astropecten sp.	Astropectinidae	Paxillosida	IN2022_V08 172	112	7	NMV F307936
Astropecten sp.	Astropectinidae	Paxillosida	IN2022_V08 172	162	1	NMV F307937
Astropecten sp.	Astropectinidae	Paxillosida	IN2022_V08 172	163	1	NMV F307938
Astropecten sp.	Astropectinidae	Paxillosida	IN2022_V08 172	164	1	NMV F307939
Astropecten sp.	Astropectinidae	Paxillosida	IN2022_V08 172	165	1	NMV F307940
Astropecten sp.	Astropectinidae	Paxillosida	IN2022_V08 172	166	1	NMV F307941
Astropecten sp.	Astropectinidae	Paxillosida	IN2022_V08 179	107	1	NMV F307877
Astropecten sp.	Astropectinidae	Paxillosida	IN2022_V08 179	108	1	NMV F307927
Astropectinidae	Astropectinidae	Paxillosida	IN2021_V04 046	125	1	NMV F307610
Dytaster sp.	Astropectinidae	Paxillosida	IN2021_V04 024	106	1	NMV F307616
Dytaster sp.	Astropectinidae	Paxillosida	IN2021_V04 033	106	1	NMV F307618
Dytaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	113	1	NMV F307897
Dytaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	216	1	NMV F307911
Persephonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 033	107	4	NMV F307615
Persephonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 037	137	1	NMV F314745
Persephonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 037	137	1	NMV F314746
Persephonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 050	108	1	NMV F307611
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 117	121	1	NMV F307873
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 117	122	1	NMV F307987
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 117	200	1	NMV F307988
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 131	104	1	NMV F307981
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 131	105	1	NMV F307982
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 131	106	1	NMV F307942
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 131	218	1	NMV F307983
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 131	219	1	NMV F307984
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 131	220	1	NMV F307985
Persephonaster sp. 2	Astropectinidae	Paxillosida	IN2022_V08 147	108	1	NMV F307956
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 159	125	1	NMV F307875
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 159	126	1	NMV F307928
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 159	184	1	NMV F307929
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 159	185	1	NMV F307930
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 163	178	1	NMV F307884
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 163	203	1	NMV F307885
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 163	204	1	NMV F307886
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 193	101	1	NMV F307951
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 193	102	30	NMV F307895
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 193	180	1	NMV F307952
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 193	181	1	NMV F307953
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 193	182	1	NMV F307954
Persephonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 193	183	1	NMV F307955
Plutonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 007	102	1	NMV F307588
Plutonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 012	112	1	NMV F307591
Plutonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 028	118	1	NMV F307598
Plutonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 040	107	2	NMV F307606
Plutonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 040	108	1	NMV F307607
Plutonaster sp.	Astropectinidae	Paxillosida	IN2021_V04 052	102	1	NMV F307613
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	112	1	NMV F307872
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	203	1	NMV F307898
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	204	1	NMV F307899
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	205	1	NMV F307900
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	206	1	NMV F307901
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	207	1	NMV F307902
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	208	1	NMV F307903
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	209	1	NMV F307904

Species name	Family	Order	Operation	Accession no	Num	Reg. no.*
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	210	1	NMV F307905
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	211	1	NMV F307906
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	212	1	NMV F307907
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	213	1	NMV F307908
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	214	1	NMV F307909
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 103	215	1	NMV F307910
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 105	199	1	NMV F307871
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 108	138	1	NMV F307882
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 108	139	1	NMV F307931
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 108	156	1	NMV F307883
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 115	131	1	NMV F307887
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 115	182	1	NMV F307888
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 122	198	1	NMV F307946
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 122	222	1	NMV F307980
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 122	237	1	NMV F307947
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 122	238	1	NMV F307948
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 122	239	1	NMV F307949
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 122	240	1	NMV F307950
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 131	221	1	NMV F307943
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 131	222	1	NMV F307944
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 131	223	1	NMV F307945
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 147	109	1	NMV F307880
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 147	179	1	NMV F307881
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 153	106	1	NMV F307932
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 153	149	1	NMV F307933
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 153	150	1	NMV F307934
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 153	151	1	NMV F307935
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 181	130	1	NMV F307912
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 181	159	1	NMV F307913
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 181	160	1	NMV F307914
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 181	161	1	NMV F307915
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 181	162	1	NMV F307916
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 181	163	1	NMV F307917
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 189	123	1	NMV F307876
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 196	109	1	NMV F307889
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 196	129	1	NMV F307890
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 196	130	1	NMV F307891
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 196	131	1	NMV F307892
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 196	132	1	NMV F307893
Plutonaster sp.	Astropectinidae	Paxillosida	IN2022_V08 196	133	1	NMV F307894
Psilaster sp.	Astropectinidae	Paxillosida	IN2021_V04 037	137	2	NMV F307623
Abyssaster tara	Porcellanasteridae	Paxillosida	IN2022_V08 183	115	1	NMV F307809
Abyssaster tara	Porcellanasteridae	Paxillosida	IN2022_V08 183	158	1	NMV F307810
Abyssaster tara	Porcellanasteridae	Paxillosida	IN2022_V08 183	159	1	NMV F307811
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	111	1	NMV F307736
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	114	1	NMV F307735
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	185	1	NMV F307737
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	187	1	NMV F307739
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	189	1	NMV F307741
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	190	1	NMV F307742
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	191	1	NMV F307743
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	192	1	NMV F307744
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	193	1	NMV F307745
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	194	1	NMV F307746
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	195	1	NMV F307747
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	196	1	NMV F307748
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	197	1	NMV F307749
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	198	1	NMV F307750

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Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	199	1	NMV F307751
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 103	200	1	NMV F307752
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 012	111	1	NMV F307590
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	162	1	NMV F307753
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	190	1	NMV F307754
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	191	1	NMV F307755
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	192	1	NMV F307756
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	193	1	NMV F307757
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	194	1	NMV F307758
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	195	1	NMV F307759
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	196	1	NMV F307760
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	197	1	NMV F307761
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	198	1	NMV F307762
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	199	1	NMV F307763
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	200	1	NMV F307764
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	201	1	NMV F307765
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	202	1	NMV F307766
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	203	1	NMV F307767
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	204	1	NMV F307768
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	205	1	NMV F307769
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	206	1	NMV F307770
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	207	1	NMV F307771
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	208	1	NMV F307772
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	209	1	NMV F307773
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	210	1	NMV F307774
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	211	1	NMV F307775
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	212	1	NMV F307776
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	213	1	NMV F307777
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	214	1	NMV F307778
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	215	1	NMV F307779
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	216	1	NMV F307780
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	217	1	NMV F307781
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	218	1	NMV F307782
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	219	1	NMV F307783
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	220	1	NMV F307784
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	221	1	NMV F307785
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	222	1	NMV F307786
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	223	1	NMV F307787
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	224	1	NMV F307788
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	225	1	NMV F307789
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	226	1	NMV F307790
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	227	1	NMV F307791
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	228	1	NMV F307792
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	229	1	NMV F307793
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	230	1	NMV F307794
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	231	1	NMV F307795
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	232	1	NMV F307796
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	233	1	NMV F307797
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	234	1	NMV F307798
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 120	235	1	NMV F307799
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	114	1	NMV F307816
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	160	1	NMV F307817
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	161	1	NMV F307818
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	162	1	NMV F307819
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	163	1	NMV F307820
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	164	1	NMV F307821
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	165	1	NMV F307822
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	166	1	NMV F307823

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Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	167	1	NMV F307824
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	168	1	NMV F307825
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	169	1	NMV F307826
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	170	1	NMV F307827
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	171	1	NMV F307828
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	172	1	NMV F307829
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	173	1	NMV F307830
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	174	1	NMV F307831
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	175	1	NMV F307832
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	176	1	NMV F307833
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	177	1	NMV F307834
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	178	1	NMV F307835
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	179	1	NMV F307836
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	180	1	NMV F307837
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	181	1	NMV F307838
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	182	1	NMV F307839
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	183	1	NMV F307840
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	184	1	NMV F307841
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	185	1	NMV F307842
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	186	1	NMV F307843
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	187	1	NMV F307844
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	188	1	NMV F307845
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	189	1	NMV F307846
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	190	1	NMV F307847
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	191	1	NMV F307848
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	192	1	NMV F307849
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	193	1	NMV F307850
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	194	1	NMV F307851
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	195	1	NMV F307852
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	196	1	NMV F307853
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	197	1	NMV F307854
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	198	1	NMV F307855
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	199	1	NMV F307856
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	200	1	NMV F307857
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	201	1	NMV F307858
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	202	1	NMV F307859
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	203	1	NMV F307860
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	204	1	NMV F307861
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	205	1	NMV F307862
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	206	1	NMV F307863
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	207	1	NMV F307864
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	208	1	NMV F307865
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	209	1	NMV F307866
Hyphalaster sp.	Porcellanasteridae	Paxillosida	IN2022_V08 183	210	1	NMV F307867
Sidonaster vaneyi	Porcellanasteridae	Paxillosida	IN2022_V08 196	110	1	NMV F307806
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2021_V04 028	117	1	NMV F307597
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 103	186	1	NMV F307738
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 103	188	1	NMV F307740
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 122	197	1	NMV F307800
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 122	233	1	NMV F307801
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 122	234	1	NMV F307802
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 122	235	1	NMV F307803
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 122	236	1	NMV F307804
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 183	116	1	NMV F307812
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 183	155	1	NMV F307813
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 183	156	1	NMV F307814
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 183	157	1	NMV F307815
Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 196	112	1	NMV F307805

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Styracaster horridus	Porcellanasteridae	Paxillosida	IN2022_V08 196	135	1	NMV F307808
Pseudarchaster sp.	Pseudarchasteridae	Paxillosida	IN2021_V04 031	109	2	NMV F307624
Pseudarchaster sp.	Pseudarchasteridae	Paxillosida	IN2021_V04 031	123	1	NMV F307621
Pseudarchaster sp.	Pseudarchasteridae	Paxillosida	IN2021_V04 053	108	1	NMV F307619
Pseudarchaster sp.	Pseudarchasteridae	Paxillosida	IN2022_V08 105	156	1	NMV F307973
Anseropoda sp.	Asterinidae	Valvatida	IN2022_V08 134	102	1	NMV F307697
Caymanostella sp.	Caymanostellidae	Valvatida	IN2022_V08 145	115	1	NMV F307709
Caymanostella sp.	Caymanostellidae	Valvatida	IN2022_V08 147	170	1	NMV F307710
Caymanostella sp.	Caymanostellidae	Valvatida	IN2022_V08 147	171	1	NMV F307711
Asteroidea	Goniasteridae	Valvatida	IN2022_V08 143	217	1	NMV F307960
Asteroidea	Goniasteridae	Valvatida	IN2022_V08 143	218	1	NMV F307961
Astroceramus sp.	Goniasteridae	Valvatida	IN2022_V08 161	109	1	NMV F307966
Atheraster umbo	Goniasteridae	Valvatida	IN2022_V08 131	103	1	NMV F307974
Bathyceramaster	Goniasteridae	Valvatida	IN2021_V04 005	137	5	NMV F307587
Bathyceramaster	Goniasteridae	Valvatida	IN2021_V04 016	106	2	NMV F307594
Bathyceramaster	Goniasteridae	Valvatida	IN2021_V04 018	101	1	NMV F307596
Bathyceramaster	Goniasteridae	Valvatida	IN2021_V04 031	120	2	NMV F307599
Bathyceramaster	Goniasteridae	Valvatida	IN2022_V08 187	120	1	NMV F307965
Ceramaster sp.	Goniasteridae	Valvatida	IN2022_V08 143	120	1	NMV F307959
Evoplosoma timorensis	Goniasteridae	Valvatida	IN2022_V08 143	114	1	NMV F307986
Goniasteridae	Goniasteridae	Valvatida	IN2022_V08 138	105	1	NMV F307962
Goniasteridae	Goniasteridae	Valvatida	IN2022_V08 183	117	1	NMV F307963
Mediaster roanae	Goniasteridae	Valvatida	IN2021_V04 018	101	1	NMV F307595
Mediaster roanae	Goniasteridae	Valvatida	IN2021_V04 020	101	3	NMV F307617
Mediaster roanae	Goniasteridae	Valvatida	IN2022_V08 128	105	1	NMV F307964
Mediaster roanae	Goniasteridae	Valvatida	IN2022_V08 128	154	1	NMV F307976
Mediaster roanae	Goniasteridae	Valvatida	IN2022_V08 128	155	1	NMV F307977
Mediaster roanae	Goniasteridae	Valvatida	IN2022_V08 128	156	1	NMV F307978
Mediaster roanae	Goniasteridae	Valvatida	IN2022_V08 128	157	1	NMV F307975
Mediaster roanae	Goniasteridae	Valvatida	IN2022_V08 128	157	1	NMV F307979
Mediaster roanae	Goniasteridae	Valvatida	IN2022_V08 134	103	1	NMV F307969
Plinthaster lenaigae	Goniasteridae	Valvatida	IN2022_V08 159	119	1	NMV F307967
Plinthaster lenaigae	Goniasteridae	Valvatida	IN2022_V08 161	108	1	NMV F307958
Sibogaster nieseni	Goniasteridae	Valvatida	IN2022_V08 103	109	1	NMV F307970
Sibogaster nieseni	Goniasteridae	Valvatida	IN2022_V08 103	110	1	NMV F307968
Sibogaster nieseni	Goniasteridae	Valvatida	IN2022_V08 103	201	1	NMV F307971
Sibogaster nieseni	Goniasteridae	Valvatida	IN2022_V08 103	202	1	NMV F307972
Sibogaster nieseni	Goniasteridae	Valvatida	IN2022_V08 105	157	1	NMV F307957
Sibogaster nieseni	Goniasteridae	Valvatida	IN2022_V08 187	119	1	NMV F307918
Lophaster sp.	Solasteridae	Valvatida	IN2021_V04 005	137	4	NMV F307586
Hymenaster sp.	Pterasteridae	Velatida	IN2021_V04 009	119	1	NMV F307589
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 124	122	1	NMV F307726
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 143	143	1	NMV F307727
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 143	144	1	NMV F307728
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 161	107	1	NMV F307725
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 163	180	1	NMV F307724
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 193	133	1	NMV F307729
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 193	175	1	NMV F307730
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 193	176	1	NMV F307731
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 193	177	1	NMV F307732
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 193	178	1	NMV F307733
Hymenaster sp.	Pterasteridae	Velatida	IN2022_V08 193	179	1	NMV F307734
Pteraster sp.	Pterasteridae	Velatida	IN2022_V08 193	132	1	NMV F307722
Pterasteridae	Pterasteridae	Velatida	IN2022_V08 122	200	1	NMV F307723
Asteroidea			IN2021_V04 040	114	1	NMV F307609
Asteroidea			IN2022_V08 113	210	1	NMV F307879

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